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FOREWORD

In their efforts to tap the benefits which can accrue from their forest resources, many governments of developing countries are creating structures, either within the existing administration or through new bodies, to promote the development of forest industries. These efforts have not always produced satisfactory results because of unclear strategies or lack of planning and management expertise. Inadequate undertakings and inefficient operations have, therefore, resulted in many cases of failure with serious social and economic consequences.

The importance for developing countries to become self-reliant, and the recognition that poor management is a major obstacle to sound industrial development based on forests, led to the organization of the Workshop on Management of Forest Industries, with a special contribution from Finland under the FAO/Government Cooperative Programme. The workshop was held from 26 August to 15 September 1984, at the Kotka College of Forestry and Wood Technology in the city of Kotka, Finland.

The Food and Agriculture Organization of the United Nations greatly appreciates the support of the Government of Finland to FAO's Regular Programme activities in the field of forest industries by sponsoring and hosting this workshop.

M.A. Flores Rodas
Assistant Director-General
Forestry Department

EDITORIAL NOTE

The papers presented in this report have been edited to the extent considered necessary for the reader's assistance.

The mention of specific companies or of their products or brand names does not imply any endorsement or recommendation on the part of the Food and Agriculture Organization of the United Nations.

Cover photo: The Schauman Savonlinna integrated forest industry complex comprises a sawmill, a hardboard mill, a plywood mill and a plywood processing mill. Note that the logs have been sorted to ensure best end use.
(Photo: Sky-Foto, Helsinki)

ABSTRACT

The First FAO/Finland Workshop on Management of Forest Industries was held from 26 August to 15 September 1984 at the Kotka College of Forestry and Wood Technology in the city of Kotka, Finland. The workshop was sponsored by the Government of Finland and organized by the Helsinki University of Technology in cooperation with the Food and Agriculture Organization of the United Nations.

The main purpose of the workshop was to train forest industry managers, supervisors and planners from developing countries in industrial and commercial management so as to improve the efficiency of these industries in their respective countries.

Particular emphasis in the workshop was laid on raising the level of self-reliance in the planning and management of forest industries. This was to be achieved not only through upper-level management techniques, but also through the application of technology in industrial logging, sawmilling, the production of wood-based panels, pulp and paper, and the organizing of information on forest resources and the marketing of forest products.

The programme included country statements, lectures, case studies, excursions, demonstrations, films and evaluation by means of multiple-choice quizzes.

The workshop was attended by 22 participants from the following 18 developing countries: Bhutan, Brazil, Cameroon, Colombia, Honduras, Indonesia, Kenya, Malaysia, Mexico, Nicaragua, Peru, Philippines, Sri Lanka, Tanzania, Viet Nam, Zaire, Zambia and Zimbabwe.

Nineteen participants were sponsored by the Finnish Government, two by FAO forestry projects and one by a private forest enterprise.

The participants included people from ministries of agriculture and forestry, public and private forest industries, university faculties of forestry and training institutions.

This document is a compilation of the lecture papers presented at the workshop. It is hoped that many forest industries managers from developing countries will profit from the information contained herein.

Wood harvesting using agricultural tractor
and trailer with hydraulic crane attachment
(photo: H. Seppanen)

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INTRODUCTION

1. ORGANIZATION AND ADMINISTRATION

The organization of the workshop was carried out in close collaboration between the Forest Industries Division of FAO, the Forestry Training Programme for Developing Countries (FTP) of Finland and the Helsinki University of Technology.

The venue was the Kotka College of Forestry and Wood Technology in the city of Kotka about 100 km northeast of Helsinki.

Professor R. Juvonen of the Helsinki University of Technology and Mr. R. Heinrich, FAO, were appointed course directors. Professor T.C. Bjerkelund of the University of New Brunswick, Canada, acted as moderator and discussion leader. Mr. A. Porteous of the Open University, Milton Keynes, England, prepared and evaluated the multiple-choice quizzes covering all the workshop training material.

In addition, more than 30 lecturers, speakers, instructors and excursion hosts contributed to the workshop programme. Lecturers from six different Finnish companies dealing with management of forest industries as well as four lecturers from the Forestry Department of FAO presented papers.

Administrative, technical and secretarial assistance was provided by the Helsinki University of Technology, the Kotka College of Forestry and Wood Technology and FAO.

2. PARTICIPANTS

The workshop was attended by 22 participants from the following 18 developing countries: Bhutan, Brazil, Cameroon, Colombia, Honduras, Indonesia, Kenya, Malaysia, Mexico, Nicaragua, Peru, Philippines, Sri Lanka, Tanzania, Viet Nam, Zaire, Zambia and Zimbabwe.

Nineteen participants were sponsored by Finland, two by FAO projects and one by a private forest enterprise.

The participants were mainly from ministries of agriculture and forestry, public and private forest industries, faculties of forestry and training institutions.

3. PURPOSE OF THE WORKSHOP

The main objective of the workshop was to train managers of forest industries, supervisors and forestry personnel involved in the planning of forest industries, in commercial management so as to improve the efficiency of these industries and raise self-reliance in the management and planning of forest industries. This can be achieved not only through upper-level management techniques but also through the application of appropriate technology in industrial logging, sawmilling and the production of wood-based panels and pulp and paper.

4. PROGRAMME OF THE WORKSHOP

The workshop was opened by the Assistant Department Chief, Mr. D. Johansson of FINNIDA, the Finnish workshop director, Professor R. Juvonen, and Mr. R. Heinrich, Chief, Forest Logging and Transport Branch, FAO.

Mr. L.R. Letourneau, Director of the Forest Industries Division, FAO, in his introductory address welcomed the participants on behalf of the Director-General of FAO, Mr. Edouard Saouma, and the Assistant Director-General, Forestry Department, Mr. M.A. Flores Rodas.

The programme of the workshop included lectures, case studies and films. In addition, seven excursions were made to wood harvesting operations, mobile sawmills, medium and large-scale sawmills, a particle board mill, a plywood mill and a planing mill. Particular emphasis was laid on the importance of managing the whole chain of activities, from development of forest resources, harvesting, forest industries to the final marketing of the end products.

Ten multiple-choice quizzes covering the workshop training material were given to the participants after the lectures. They were designed as a means of measuring the effectiveness of the workshop as well as to get a feedback for further training programmes.

Participants presented country statements including the main statistics on forest resources, annual cut, production, imports and exports of forest products as well as the number of forest industries. The main constraints and future development strategies were discussed.

INTRODUCTION TO FORESTRY AND FOREST INDUSTRIES IN FINLAND

by

Risto Juvonen
Helsinki University of Technology

1. INTRODUCTION

The forest is home to the Finns, and has been since the first people moved to their remote land in the north some 6 000 years ago. It provided them with their livelihood, their clothing and their dwellings. From generation to generation Finns wrested fields from the forest with their own hard labour and sweat. They cut down the trees, burnt them and planted seeds in the fertile ash.

To the Finns the forest is treasure; when used properly it is an inexhaustible natural resource. The bounty of the forest is the only significant domestic raw material; it is as valuable as oil, and fortunately renews itself constantly.

In Finland forestry is closely bound up with two other sectors: forest industry and agriculture. The need to protect forests was recognized as early as the 17th century, although forestry proper did not emerge until the second half of the 19th century, when the industrial revolution in Western Europe began to exert its influence over Finland through rapid growth in the demand for lumber.

The demand for Finnish timber in England and in Western Europe in general was so great that economic constraints to the sawmill industry were overcome by the burgeoning strength of the industrial revolution. Then with the establishment of the groundwood and pulp industries, the former in the eighteen eighties and the latter in the eighteen nineties, the foundation for the subsequent decades of forest industry development was laid. As it was a rapidly expanding branch of the export industry, it triggered an economic boom.

At the beginning of the nineteen twenties the outlook for the development of forestry and the forest industry in newly independent Finland showed both positive and negative features. A positive feature was postwar reconstruction in Western Europe and the consequent demand for lumber.

The new political situation in Europe caused a special kind of problem for the Finnish pulp and paper industry: the traditional Russian markets were closed and new ones had to be sought in the West. Closer cooperation between companies was one way in which this problem was solved and, in fact, penetration of the Western European market was achieved with less difficulty than anticipated.

Despite setbacks caused by periods of economic slump, the most serious of these being during the worldwide depression of the nineteen thirties, the Finnish forest industry grew in the years between the world wars. New plants were built, particularly pulp, paper and plywood mills, and not with foreign capital as had been the case in the early days of industrial development, but primarily with funds accumulated by the Finnish companies themselves.

2. OWNERSHIP

In the early years after independence was won, policy on forest ownership sought to increase private ownership of forests and emphasized combined farming and forestry.

Even today, the vast majority of our forests are owned by 300 000 private individuals. In terms of area, 65% of Finland's forests are owned by farmers and other private citizens. The state - primarily the National Forest Board - owns a scant 25%, municipalities and religious congregations 4%, and forest industry companies 7%. Previously, private forests were almost exclusively woodlands forming part of farms.

Mainly as a consequence of estate division, it is estimated that more than 30% of the private forest area is now owned by non-farmers. It is also estimated that the number of these forest holdings and their area will account for nearly half of the private forests in Finland at the end of the century. The average size of private forests (woodland area) is at present 35 hectares.

3. SPECIES

Pine is the principal wood species in Finland; it accounts for 45% of the growing stock. Spruce accounts for 37% and hardwoods for 18%. In southern Finland spruce has become the main species, and it will grow in importance at the expense of hardwoods. In northern Finland pine is clearly dominant. The volume of growing stock, and above all of spruce, is concentrated in southwestern Finland where growing conditions are best.

Finland is one of the world's most highly forested countries. Land given over to forestry accounts for 88% of the total land area (338 000 sq.km.) and woodlands proper for 65%. Finland has about 4.5 hectares of forest per caput, while the corresponding figure for the whole world is about 1.2 hectares and for Europe only 0.3 hectares. Although the importance of our forests is great, they account for only 0.5% of the world's forest area, which is approximately 2.8 billion hectares.

The annual growth rate for the whole of Finland is 3.3 m^3 per hectare with an average of 4.6 m^3 per hectare in southern Finland, where growing conditions are most favourable.

4. SUPPLY OF RAW MATERIAL

The capacity of Finland's forest industry has been a matter for discussion. In the long term, the main problem concerns the sufficiency of raw wood. The so-called Forest 2000 programme on the raw material situation of the Finnish forest industry for the purpose of long-range wood utilization and planning was recently drawn up by experts.

The programme estimates the wood volumes available up to the end of the century and suggests the following ways to improve the supply of raw wood to the Finnish forest industry:

- improved forest management and intensified forest improvement;
- more efficient use of wood in industry, e.g. increased use of industrial waste wood;
- more efficient wood harvesting, e.g. use of forest residue (branches, stumps, crowns and waste stem wood) for industrial purposes.

The report also assumes that the use of wood for other than industrial purposes will continue to decline, and that imports of wood will remain at basically the same level although a slight drop is anticipated. (A maximum of more than four million m^3 per annum in raw and waste wood has been imported from the Soviet Union).

It is estimated that industry will need 48 million m^3 per annum of raw wood annually by the end of this decade. However, it is also anticipated that more than 50 million m^3 of raw wood, both domestic and foreign, will be available for industrial use. The annual volume of additional local raw wood should rise to 6 million m^3 per annum at the beginning of the nineteen nineties and should be nearly 10 million m^3 per annum at the turn of the century.

When completed, the projected expansion in the capacity of the pulp and board industry will make use of all the waste wood presently produced by the sawmill and plywood industry. At the turn of the decade it is estimated that more than 10 million m^3 a year will be produced and consumed.

The role of residues will be increasingly important in the future. If the Finnish forest industry were able to harvest and utilize the forest residue left by economic modern cutting methods, a substantial additional reserve of raw material would be available. At present stumps, branches, crowns and other waste stem wood remain in the forest; their use would mean an increase of more than 25% in the available wood volume. If more economic uses for bark could be found (it is presently used primarily as a fuel), then it, too, would provide a substantial reserve for the forest industry.

The problem is how to get the wood to the mills for a price that industry is able to pay. The price of wood at the mill in both Finland and Sweden is more than twice that in the southern United States. One reason for this was mentioned above: the lack of maximum utilization of forest resources. Another is the shortness of the growing season, and harvesting is expensive due to the fragmented nature of forest ownership.

The second important instrument in the regulation of wood use at present is the agreement between the Finnish forest industry and the Bank of Finland. According to this 1970 agreement, the forest industry must attempt to keep its investment plans within the limits permitted by forest reserves and to prevent the creation of overcapacity that might threaten the value of the Finnish mark.

Changes in the structure of business and improvements in production technology have resulted in a constant decline in the percentage of the gross national product contributed by the forest industry. In 1930, it was 14%; in 1960, somewhat less than 9%; and it is somewhat below 5% at present. A decline to around 3% by 1990 is anticipated.

Stumpage income accounts for about half the percentage of the gross national product contributed by forestry. Since the annual costs of raising a stand are relatively small, private forest owners can finance consumption and improvements in farming and livestock operations with their forest income.

5. PRODUCTION AND EXPORTS

Wood in many forms has contributed to the development of the Finnish nation over the centuries. It is said that our first wooden export products were parts of bows fashioned from Aland yew. If this is true, then these early exports must have been made some time in the Middle Ages.

The bows were undoubtedly first-rate by the standards of the times, but their export value cannot have been very great. In any case, this trade was not of great economic importance to Finland.

Exports of tar from the 17th to the 19th century brought useful goods to Finland through barter, and raised the standard of living, particularly in the coastal towns. Other important exports were spars and wooden dishes, and in the 18th century wooden ships.

The Finnish sawmill industry began to grow in the eighteen seventies, the wood-based paper industry in the next decade, and the pulp industry in the next. Up to 1913 the sawmill industry accounted for most exports, but when access to world markets was denied during the first world war, it was surpassed for the first time by the paper and pulp industry, which sold most of its production to Imperial Russia.

Timber has indeed been Finland's "green gold"; the first-rate sawmills, factories, production plants and the flourishing communities that evolved around them all owe their existence to timber. The claim that Finland's standard of living and well-being is based on the forest industry is justified.

A glance at Finnish export figures since the nineteen twenties shows that forest industry products have accounted for 70-80% of total exports. In any case, income from wood has formed a solid base for the Finnish economy for more than a century, since 1858 when termination of a ban on the use of steam set off a period of rapid growth for the sawmill industry. The dominant position of the forest industry in exports which are crucial to the economic growth of a small country with a narrow range of natural resources has been preserved up to the present. Only during the last three decades, when Finland was fast being transformed from an agricultural to an industrial state, did the share of processed wood products in total exports decline to its present level, which is slightly below 50%.

This reduction in the percentage contributed by Finland's basic industry has not, however, resulted from a drop in the export of forest industry products. Instead, it is a consequence of the rapid growth of metal and engineering exports. We can state with satisfaction that new sectors of industry have joined the forest sector in moulding and developing Finnish society.

As export-oriented sawmills rapidly expanded their production and consolidated their position, industrial communities arose around them. In many cases the growth of these communities received a further boost when the manufacture of paper from groundwood began. It must be borne in mind that at the time groundwood mills were first set up it was not possible to transfer power, and thus mills had to be built on rapids so they could be linked directly to water-powered turbines.

Sawmills were not nearly so dependent on natural power, for the wastes they produced were a source of abundant fuel. Chemical pulp mills were also partly self-sufficient in power supply, and moreover, by the time the first pulp mills were built, it was already possible to transfer power by means of electricity. In this way the map of Finnish forest product industries was transformed.

At present the industry accounts for about one-fifth of the total values of industrial production. It employs some 100 000 people or a good one-fifth of the industrial work force.

The sawmill industry is the largest branch of the mechanical forest industry. In Finland more than 300 sawmills engaged in exports on a regular basis produce a total of about 90% of our lumber. Moreover, there are more than 7 000 small sawmills and installations that produce for household consumption, but not on a permanent basis. The processing of raw materials, production techniques, product classifications and delivery methods have developed considerably during the last 15 years.

The main products of the plywood industry are plywood, mixed plywood grades made of spruce and birch, plywoods coated in various ways, blockboard and laminated board. At present there are a total of 26 plywood mills in Finland.

Chipboard, which is the most recent innovation of the board industry, is made of small chips and resins. The growth in demand is based primarily on increased use in the building and furniture industry. There are 11 mills in operation. The chipboard industry in both Finland and Sweden is some 40 to 50% dependent on export demand. Since this industry is based on the availability of cheap raw material, there was a rapid development of chipboard export capacity on the European continent in the nineteen seventies.

Fibreboard is manufactured from groundwood. Production in this industry is divided into hard, semi-hard and porous board. There are five fibreboard mills in Finland.

The percentage of the total fibreboard production accounted for by exports from Finland and Sweden dropped substantially in the nineteen seventies because of reduced export demand and the closing down of obsolete fibreboard capacity.

Four-fifths of the forest industry's production is exported. Although the industry's share of total exports has declined as industry has diversified, it still accounts for nearly 40% of the value of exports, and since the forest industry consumes a very small volume of imports compared with other fields, its exports produce a large net gain in foreign exchange and therefore benefit the Finnish economy as a whole. The net revenues on 100 marks' worth of exports are about 80-90 marks, depending on the product.

Finland is relatively unimportant in the world's trade; she accounts for less than 5% of the total. In forest product exports, however, the figure is about 10%. As an exporter of paper and board, we rank second only to Canada; in pulp exports we are in fourth place behind Canada, Sweden and the United States. Although Finland accounts for only 10 to 12% of Europe's paper and paperboard production, she accounts for some 30% of the exports of these products.

The significance of exports for the Finnish sawmill industry is comparable to that for Sweden or Canada, our competitors. By contrast, the Soviet Union exports only a marginal 7 to 8% of its total production.

However, the Soviet Union does export some 8 million m^3 annually to Europe, and this is why its position on the European market is so important. Canada is much less important in the European market, for most of its exports go to the United States.

The Finnish plywood industry is relatively more dependent on export demand than the Canadian industry. Exports of plywood from the United States have thus far been minor.

6. MARKETS

Europe is by far the most important market for Finland's forest products, and as far as markets are concerned, the changes that have occurred in the postwar period are not nearly as great as those which individual goods have undergone. The percentages for the various free-trade areas have remained virtually constant since the nineteen fifties. The most important areas are the EEC 1/ and EFTA 2/, where nearly two-thirds of our forest industry exports go.

Of the two the EEC is clearly dominant, because it is presently the world's largest importer of wood and paper products, while most of the EFTA countries are themselves net exporters of forest industry products and therefore rivals of Finland in this sector.

The Eastern Bloc - the European CMEA 3/ countries - are in second place. Some 15% percent of our exports go to these countries. The Soviet Union is by far our largest customer in the CMEA group.

During the past 30 years, cooperation between the forest industries of Finland and the Soviet Union has constantly expanded and diversified. The structure of Finnish forest industry exports to the Soviet Union has undergone a process of change similar to that which has taken place in our exports to the Soviet Union in general. Lumber, which was originally the most important item, has been surpassed by the growing volume of pulp and paper products. In recent years, scientific and technical cooperation with the Soviet Union has increased alongside commercial contacts. This is in itself very natural, since both countries have abundant forest resources of a similar nature.

The Mediterranean is another important region for forest industry exports. The main countries here are Spain, Greece and Turkey. When these countries are taken into account, it can be said that a good 80% of Finland's forest industry exports go to Europe. The remaining 20% is divided as follows: on an average nearly 8% to Latin America, a good 3% to Africa, 2.5 to United States and Canada, 2.5 to Latin America, less than 2% to southwest Pacific and 2% elsewhere. Fluctuations do occur from year to year.

7. MACHINERY AND EQUIPMENT

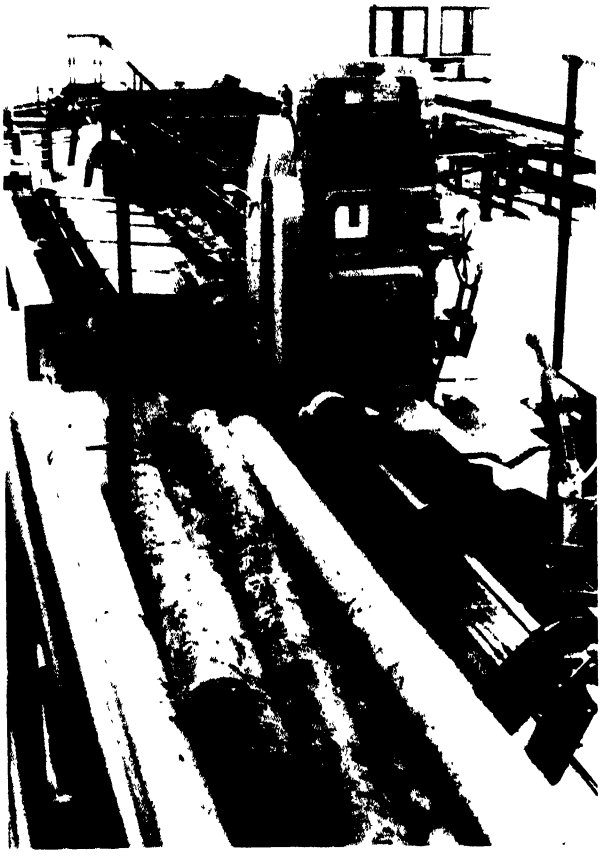
This picture of Finnish forestry and the forest industry would not be complete without mention of the developments that have taken place in the production of machines and equipment. In this field the Finnish metal-working industry has traditions extending back to the 19th century.

The most rapid developments, however, have taken place since the second world war. In the immediate postwar period a manifold increase in the metal and engineering industry had to be achieved in a few short years. While the largest orders in the beginning went to the Soviet Union to pay war indemnities, markets gradually opened up elsewhere, and now machines made in Finland for wood harvesting and processing are exported to every continent.

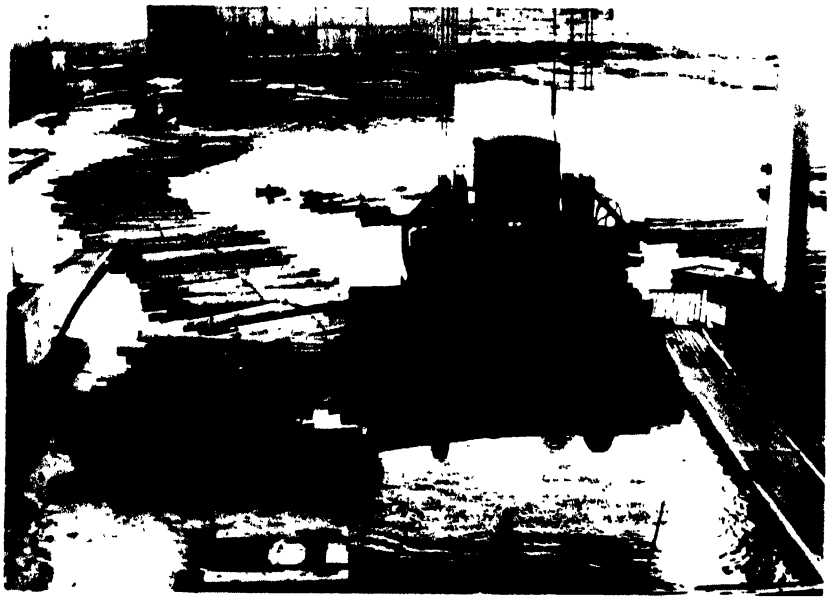
1/ EEC: European Economic Community
2/ EFTA: European Free Trade Association
3/ CMEA: Council for Mutual Economic Assistance

The high technical standard of this industry has won acclaim in various parts of the world; repeat orders from countries with long traditions of their own in metal-working and machine construction are the evidence. Successful deliveries of entire sawmills and plywood, pulp and paper mills are additional proof of the high standard achieved by this sector of Finnish industry.

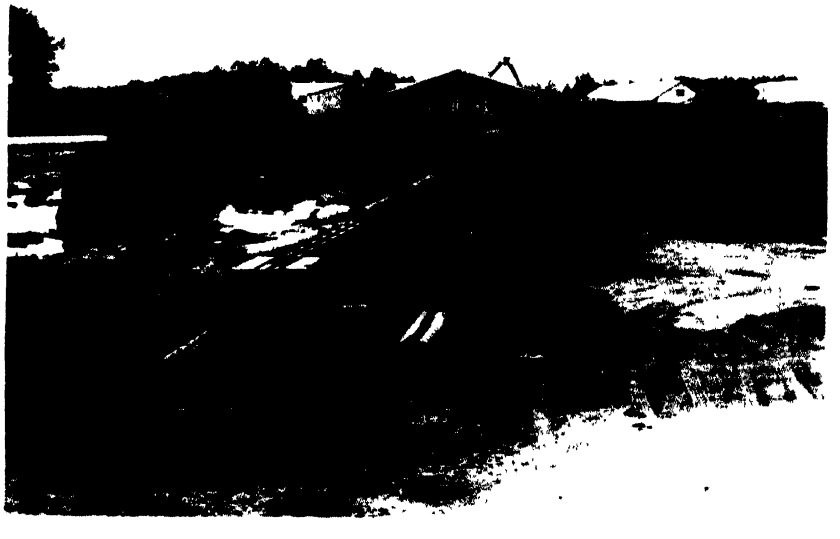
One of the strengths of the Finnish machine construction industry is its close contact with the country's own excellent wood-processing industry, which has served as a laboratory or testing ground. Rarely does a country's machine construction industry have such a close relationship with a processing branch.



Frame saw (log infeed side)
(Photo: Raute Oy)



Lifting of log bundles from water storage
(Photo: H. Seppanen)



Log sorting and grading station at a small-scale sawmill.
Logs to be sorted and graded are stored in water at left.
(Photo: H. Seppanen)

APPROPRIATE FOREST BASED INDUSTRIES

Secretariat Paper
introduced by

L.R. Letourneau
Forest Industries Division
FAO Forestry Department

1. INTRODUCTION

Forest-based industries are comprised of those activities that are associated with the use of the forest to supply society with marketable goods and services. In recent years much has been written about what constitutes appropriate industry particularly as it applies to industrial development in the currently less developed countries. This problem rarely emerges when the industrial development evolves locally in response to changing social needs and to opportunities that are locally perceived. The appropriate industry problem generally comes from change induced from outside the local society. The appropriate industry (or appropriate technology) issue, first given high visibility by the British economist E.F. Schumacher 1/, is related to industry or technology transplant, i.e. the introduction into one society of a technology or industry which evolved in another. The fact that problems can arise when industry or technology is transplanted does not argue against doing it. It simply argues for doing it right and for fully understanding the nature of the transplant operation and the consequences of the operation before undertaking it. Just as organs transplanted from one human being to another can fail to function properly or at all in the recipient, or can be rejected by the recipient, so industries and technologies transplanted from a donor society to a recipient society can also yield disappointing results.

Unfortunately, the question of whether an industry is appropriate for a developing country has sometimes been confused with arguments about whether development itself is appropriate or whether industry is inherently good or bad. It often leads to a search for simple-minded solutions in the small is beautiful rhetoric and it is sometimes submerged in the more strident forms of environmental evangelism.

The search for an appropriate industry or, within such an industry, appropriate technologies, is not a new one and it is not confined to less developed countries. It is just as important in achieving sound industrial development in developed countries. In both settings there are heavy penalties associated with failure to make wise developmental choices. It is true, however, that some emerging industrial societies are more fragile when confronted with industrialization or industrial expansion than are their more robust counterparts in the developed countries. It is here that catastrophic transplant failures can occur.

1/ Schumacher, E.F. - Small is Beautiful: Economies as if People Mattered New York: Harper and Row, 1974.

2. PATTERNS OF INDUSTRIAL DEVELOPMENT

Since the question of appropriateness of an industry or a technology is a function of industrial development, it may be useful to review more or less typical patterns of industrial evolution. In an emerging industrial social environment the industries tend to be artisanate in character with an individual entrepreneur producing, for example, a hand hewn canoe from a log and selling or bartering it to a neighbour. If he develops a reputation for producing a hand hewn canoe of very high quality at a fair price, his product may be in such demand that his personal canoe building efforts may not be productive enough to permit him to supply all of his potential customers.

Under these circumstances, he has several options. One option is to pursue a no-growth/no-development alternative of simply continuing his current programme of producing a limited quantity of the product. Perhaps he will raise the price to achieve some personal gain.

A second possibility is to train some relatives or friends to work for him, performing the hewing task in the same careful manner that has characterized his work so that a canoe of similarly high quality is produced. Thus he multiplies his pair of hands by two or three or more.

Since it is his personal reputation that has attracted the business, he must supervise the work of those he has trained to be certain that his standard of quality is maintained and that the work of many hands is comparable to his own. He may no longer have the time to hew canoes himself. Now that he has employees he must also maintain an order file to keep his organization busy. He has the rudimentary beginning of a mass-production operation with its attendant requirements for production control, quality control and marketing. Education and training as well as management have become an important part of what was once a one-man artisan activity.

If the emerging industrialist wishes to expand his operation further, he can add some more sophisticated technology. He can, for example, invent a new tool that will permit his employees to produce a better canoe in a much shorter period of time.

So far this has been an orderly development but suppose that our entrepreneur discovers that in another society there are machines like chainsaws and electrically powered drills that ought to make possible an increase in the productivity of his employees, perhaps improve product quality and hopefully profitability. Now this industrial development is confronted with a technology or industry transplant from another society; a modest one perhaps, but a transplant nonetheless. It raises a number of questions.

The employees do not know how to use these new tools. Can they learn these skills as well as they learned the earlier hewing skills which were already not unfamiliar to them? Who will teach them the new skills? The entrepreneur taught the old ones himself but he does not personally have the new skill capability. Will these new tools really produce a better product or a less costly one? Is it in fact easier and more cost-effective to train some additional local people in the old hewing skill to increase the size of the operation than to introduce the new tools and new skills? Can the essential supplies of petrol for the chainsaw and electricity for the drills be assured at a reasonable cost and on a dependable supply basis?

The answers to these questions and other similar ones may provide clues to the success or failure of the technology transplant operation if it is to be undertaken. This is a relatively simple one and its probability of success should be high.

Supposing the proposed change in the canoe production process had been more drastic and had involved, for example, a complete change from a dugout canoe to a planked boat with all of the attendant changes in technology implied. This would have represented an even greater industrial transplant and would have been even more difficult for the recipient society to accept. Even more drastic transplants could be contemplated and the difficulty of assimilation would increase. Soon one might confront the question: is the industry appropriate?

3. EVOLUTION OF A LUMBER MANUFACTURING INDUSTRY

It is interesting to trace the typical evolution of a lumber manufacturing industry. This is an industry whose basic objective is to take a round log and to convert it into a timber or board that is square or rectangular in cross-section.

The first stage in developing a manufacturing operation designed to produce this product has been either to cut the slabs off with an axe in a hand-hewing operation or to saw the boards and planks by hand with a rip-saw in a pit-sawing operation. Both of these manufacturing operations are still used extensively in many developing countries and they serve a very useful purpose in the production of structural wood commodities.

In each case these production operations have limitations. They are highly labour-intensive and the output of product per man-day is relatively low. The two processes are also limited in the size of log that can be effectively and efficiently processed. Very large, dense logs are heavy and difficult to move by hand into place for hewing or pit-sawing. They are difficult to hew and to pull a saw through in a pit-sawing operation.

The log movement problem can be alleviated by using animals to assist in logging and log positioning and turning. But the next stage in the manufacturing development is to mount a saw in a reciprocating sash structure and to move it by water power. This development leads to the installation of several saws in the reciprocating sash mechanism, converting it to a gang saw. Internal combustion engines and electric motors may replace water power. This is followed by substituting circular and band-saws for reciprocating saws to increase saw speed and by adding various types of carriages and associated equipment to facilitate loading and turning heavy logs and to improve the yield of the upper grades of lumber.

The next stage in sawmill development is to develop a multiple machine operation where only the initial breakdown is performed on the head saw with subsequent ripping and crosscutting operations being performed on separate machines designed for these special purposes and more efficient in performing them. Materials-handling equipment - trucks and powered conveyors - help move the partially manufactured lumber from one machine to another. Finally the operation of many of the machines may be computer-assisted to permit faster and more accurate operator decisions. Meanwhile out in the forest the animals used in logging may be replaced by trucks and tractors and cable-skidding and transport systems to increase the productivity of labour, make possible the handling of long, large and heavy logs and permit access to formerly inaccessible parts of the forest.

Since all of these various stages of development are satisfactorily used in some places in the world, clearly they are all viable under some circumstances. The question is which is the most appropriate in a

specific society at a particular point in time? If the current technology and methodology being used by the less developed society is satisfactory, then development is not needed and the current technology is likely to continue in use. If it is desirable to increase the productivity of employees, increase the yield of product from trees and logs or improve upon the quality of the finished product in response to market demands, then some development would seem to be appropriate. The question is how much and how fast? If the changes are slow and take place in small increments, then assimilation by society is likely to be relatively painless. If they take place very quickly and in large increments then they may be much more difficult for society to assimilate and chaos may result.

With reference to the evolution of the sawmill industry it is worth noting that size is not necessarily related to technological sophistication. The largest sawmills are often those that are built to process very large and heavy logs that derive from the exploitation of natural forests. These mills often have quite primitive materials-handling equipment and therefore must maintain large volumes of work in process at transfer points in order to buffer the changes in demands on machines.

As the forest system develops into intensively managed forests with smaller and more uniform raw material supplies and more efficient materials-handling facilities, the size of the mill can decrease. The same situation prevails at the logging end of the operation. It is the harvesting of large, heavy, old-growth trees that requires very large tractors, yarders and trucks. The small is beautiful concept may have some validity in the evolution of lumber manufacturing and logging facilities, but for different reasons than those contemplated by the proponents of the doctrine.

An even more difficult assimilation problem emerges when the prospect is not for transplant of a technology or technologies but of a whole industry.

Suppose a foreign firm with an international reputation for manufacturing fibreboard is seeking a new factory site with a potentially good source of raw material. And suppose that it selects as its potential location a less developed country with no previous experience in producing fibreboard, perhaps at the invitation of that country. Whether the operation is undertaken as a wholly foreign-owned venture or as a joint venture, it is likely to represent a major industrial transplant. The managerial skills, the technological skills and the marketing skills usually must all be transplanted. This is not necessarily bad if it is clear from the beginning that this is a transitory situation and that these aspects of the transplant will become part of the body of the recipient society and that this is one of the objectives of the enterprise. If these features of the industry are viewed as foreign bodies in the recipient society then the transplant operation may have a low probability of success.

Historically there have been spectacular successes, both in introducing new technologies into established industries and in introducing new industries into a recipient society, but there have also been some colossal failures.

4. APPROPRIATENESS OF INDUSTRY OR TECHNOLOGY

The critical questions to be asked and answered in seeking to assess the appropriateness of an industry or a technology for a developing country are the following:

1. What positive contribution does it make to general social development?

2. What cost is incurred in adverse social impact?

3. What is the trade-off?

Any time there is change in social structure, there is an impact upon the citizens of the society. For some the impact will be positive and the change will be seen as good, and for others it will be negative and the change will be seen as bad. If the change occurs gradually in small increments, the adverse effects may be quite easily accommodated in an evolutionary mode and the change may be assimilated quite well. If it occurs suddenly in a quantum jump, as is sometimes the case with a transplant from another society, the adverse impacts may be great and difficult to assimilate. Some of the kinds of questions that might be raised in assessing the social costs and benefits associated with the introduction of a new technology or industry are as follows:

1. What is the industry's potential contribution to GNP?

2. What is the industry's contribution to full and rewarding employment? Will most of the best positions in the industry go to expatriates and remain with them or will local citizens share in the advantages of more productive and rewarding labour?

3. Does the industry result in substantial export of capital?

4. Does the industry contribute to a more favourable balance of trade for the country?

5. Will the industry contribute to the development of infrastructure and support of general government services or will it make excessive demands upon limited government resources available for these purposes?

6. Does the industry lead to increase in value added to natural resources?

7. Will everyone benefit or just a few?

No doubt there are other questions that could be asked, but it is questions like these that should be raised to determine whether the development is, on the whole, positive for the country. Good forest-based industrial developments can make major positive contributions to a nation's growth, whether this industrial development arises as an evolutionary process or as a much more rapid industrial or technological transplant. In a lecture delivered in Rome in 1981 the Prime Minister of India, Shrimati Indira Gandhi, argued the case for evolutionary development from a social vantage point when she said:

> "The absorption of technology is a matter not merely of calculating costs and benefits, prices of technology, costs of labour displaced or revenues of product achieved. Technology has an impact on society - the mode of living and the relationship between people and institutions. Technological changes cannot be abruptly imposed. It has to be a process of evolution. However modern, however beneficial a technology, it has to fit in with indigenous culture and capabilities, and harmoniously transform tradition into modernity."

The less developed country that wishes to import an advanced industry or technology has several alternatives in seeking a source for transplants:

1. It can send people to a more technically advanced country to learn about the advanced industry or technology so that they can return and adapt it to the local forest sector.

2. It can employ technologists or technical consulting firms from a more technically advanced country to adapt the advanced industry or technology to the local forest sector.

3. It can invite a foreign corporation that uses the advanced technology to undertake forestry operations in the country either as an independent commercial venture or as a joint venture with local people or institutions.

The choice of transplant method is a matter of opportunity or of convenience. The first method is expensive and time-consuming but probably most satisfactory in the long run and least likely to result in total incompatibility. The second method is more expensive than the first but faster, and can sometimes be arranged through technical assistance programmes. The third method is the least costly in terms of out-of-pocket expenditures and probably the most common of all.

5. ROLE OF FOREIGN COMPANIES

There are mixed emotions about the role of foreign companies in the developing world whether they are in the consulting or operating mode. Wionczek 1/ discussed the controversy about the role of multinational corporations in the transfer of industrial technology from developed to less developed countries and concluded that this issue ought to be resolved for the following reasons:

1. The available evidence strongly suggests that transnational corporations represent a permanent feature of the world productive structure, particularly in the field of manufacturing.

2. Since transnational corporations are a major worldwide source of modern technology, it is highly likely that most of the technologically underdeveloped countries will continue to depend for quite some time upon technology produced, owned or controlled by global firms.

3. Developing countries have become increasingly dissatisfied not only with the terms and the conditions of technology transfer through transnational corporations, but also with the results of such transfers.

Wionczek identified three different views of this controversy as the "orthodox" viewpoint, the "radical" position and the "reformist" school. The "orthodox" view is that technology that is developed in the industrially advanced countries is appropriate and will meet the needs of the less developed countries. It also holds that commercial transfer of this technology from transnational corporations is the most efficient mechanism for transfer.

1/ Wionczek, M.S. - Measures strengthening the negotiating capacities of governments in their relations with transnational corporations, Technical Paper ST/CTC/U. Centre of Transnational Corporations, New York, 1979.

The "radical" position as identified by Wionczek is that the technology developed in industrially advanced societies is not useful to the less developed countries because their social and economic status is different. This doctrine holds that the imposition of technology from developed countries on less developed countries inhibits the development in the less developed countries of more appropriate technology.

A more or less centrist position is represented by the "reformist" group. They argue that less developed countries need a mix of evolutionary and transplanted technologies, the latter being available largely through transnational corporations.

The role of the foreign company in providing advanced technology and the industries based upon advanced technologies to less developed countries has received much attention recently. Most of this attention has been focused upon the problems associated with the use of these corporations as sources of new industry. But foreign companies have been the most important sources of new forest product industries in the less developed countries. In its proclamation of the Third United Nations Development Decade in December 1980, the UN General Assembly recognized both the positive and negative roles of transnational corporations in development when it referred to the UN efforts directed at "preventing - with a view to eliminating - the negative effects of activities of transnational corporations and promoting the positive contribution of transnational corporations to the development efforts of the developing countries, consistent with the national development plans and priorities of those countries". If this prescription for involvement of transnational corporations in development is followed in the negotiations between less developed countries and transnational corporations, some of the issues surrounding the appropriateness of industries and technologies might be resolved before they became major problems. It is important to understand at the outset that the objectives of a foreign corporation and of the less developed country may not be the same and, in fact, are not likely to be the same. It is generally possible, though, to harmonize the two sets of objectives and unless they are harmonized, the marriage ought not to be consummated.

Most of the problems of incompatibility in the forest sector arise when foreign companies are invited into a country to engage in exploitation of a natural or secondary unmanaged forest. The typical short-term nature of most concession agreements discourages the implantation of technologies appropriate to production forestry systems. Proprietary technology is a valuable corporate asset and it is not likely to be given away by a private corporation, particularly when that corporation has a prospect for a relatively short tenure in the country. Proprietary technology can be part of the currency of the concession contract provided that it is for sale and that agreement can be reached on its price.

6. ECONOMY OF SCALE

In the rhetoric of appropriate industry and appropriate technology the question of economy of scale is often debated. Where significant fixed costs are an attribute of an industry, increase in size and therefore in the number of units of product manufactured per unit of time permits spreading fixed costs over more output and, therefore, reduces per-unit product cost. This is one of the principal bases for the so-called economy of scale. Small industries can sometimes compensate for these apparent advantages in a number of ways. More flexibility in the use of labour commonly possible in small factories can often result in reduction in both fixed and variable costs. Change-over from one product line to another can often be accomplished more easily in a small factory than in a large one.

Often overlooked in considering appropriate industry is the fact that there is a technology of scale as well as an economy of scale and sometimes technology of scale is more important in determining the size of a unit of manufacturing. For example, a sawmill that is a lone manufacturing facility producing only lumber may be quite small, as in the case of some small portable circular sawmills. If a chipping facility is added so that the residues of lumber manufacture can be converted to pulp chips as a second product, the minimum size of the sawmill may well be dictated by the smallest capacity of chipper available if the chipping operation is to be financially feasible. Similarly, if it is desirable to co-generate electricity and steam either to make the sawmill energy self-sufficient or to provide energy as an additional product of the factory and to base this energy generation on sawmill residues, the minimum size of the sawmill may be set by available energy technology, i.e., what is the smallest feasible steam turbine.

A similar situation often prevails with respect to the pulp and paper industry. In the chemical pulping industry it is often the energy recovery and chemical recovery components that dictate the minimum size of the mill, not the requirements of the fibre line. In a similar fashion the air quality standards legislated by many countries in the last two decades have established the minimum size of some chemical pulp mills.

In the case of a pulp and paper industry the problems of appropriateness may be great. They are more critical in some segments of the industry than in others. Paper mills which utilize waste paper either locally collected or imported are often of a size and represent a capital investment that is manageable in a less developed country. Sometimes such mills can be supplied with pulp manufactured on a small scale from agricultural residues, where the pulp production represents a modest capital investment. New developments in the field of mechanical and chemi-mechanical pulping are potentially very promising as relatively low-cost installations in less developed countries. It is in the field of chemical pulping that it is often not feasible to develop a mill with a capital requirement in the range that can be managed by a small, less developed country without a massive infusion of foreign capital. It offers the opportunity to reduce traditional overhead costs.

It is interesting to note that increased use of computer technology (currently the zenith of advanced industrial technology) by the wood-using industries promises to negate some of the traditional sources of economies of scale.

7. TRANSPLANTING OBSOLETE TECHNOLOGIES

An idea that emerges frequently when appropriate industry or appropriate technology is discussed is the proposal that the industrially advanced countries ought to reach into their bag of obsolete technologies for transplant candidates for developing countries. The basis for this proposal is that conditions in the less developed countries are more comparable to those that prevailed in the developed countries several decades ago than to those prevailing today. Fifty years ago in many of the presently developed countries, labour was plentiful and inexpensive, logs were of high quality and cost very little and capital for investment in equipment was relatively expensive.

Since these are conditions that prevail in many less developed countries today, the temptation to "turn back the clock" in the search for technology to transplant is sometimes great. In this process, however, it is easy to forget that the logger who used a steam donkey engine in 1930 did not have the option of using a large diesel-powered

tractor. The sawyer with a steam-powered mill driven with flat belts did not have available an efficient internal combustion engine with V-belt drives. Overlooked too is the fact that there are no manufacturers of new but obsolete equipment. It cannot be purchased "off-the-shelf". There are few who know how to operate obsolete equipment or to teach others how.

This early equipment also had significant deficiencies vis-à-vis more modern equipment. It was often heavy and immobile. A logging railroad is much less flexible than a fleet of logging trucks. A steam skidder is less adaptable to changing conditions than is a diesel logging tractor. This is not to say that some of the principles involved in early machinery design are not applicable in the circumstances of some less developed countries, and they should not be written off because they are no longer used in more developed countries. Steam engines are easier to build in some less developed countries than are diesel engines and they are certainly easier to maintain using locally available materials and locally prevalent maintenance skills. This is particularly important when a forest-products logging or manufacturing operation is located in a remote and inaccessible rural area. Often a minor equipment failure can be repaired at once rather than wait for a small spare part to be shipped in from 5 000 miles away. Fuel to power such an engine is the wood at hand rather than a fossil fuel that has to be imported.

Certainly, there should be no hesitancy to use technology developed half a century ago just because it is old. Perhaps more appropriate would be the adaptation of old and currently little-used technology to modern conditions in less developed countries.

8. DECISION TO START AN ENTERPRISE

When it is proposed to establish an industry in a less developed country or to expand one that is already established, there are usually several levels of decision required to initiate the enterprise. The industrialists must decide whether the new or enlarged business activity is in fact a viable activity from a business standpoint. The government typically enters the decision-making process at a number of points. Presumably the government and the business interests converge at least at the primary objective level. As was noted in a secretariat note on appropriate forest industries presented at the Sixth Session of the Committee on Forestry (COFO):

> "The first condition for a forest industry to be appropriate is that it be financially and/or economically viable".

Presumably the interest of government and businesses will coincide in this objective. But government represents society as a whole and in this capacity it must also be concerned with the impact of the new or expanded industry upon society from a number of vantage points. The appropriateness of a forest-based industry for a less developed country can be assessed by examining five relevant questions:

(a) What products are needed?

The objective of any forest-based industry is to produce goods or services from the forest than can be marketed at a profit. Forest-based industries may be created to produce structural or decorative wood products or fuelwood, forest foods such as meat from livestock, wildlife, seafood, mushrooms or honey; non-wood products like resins, gum, rubber, thatch, rattan, or services such as recreation. From a practical standpoint, the major sources of controversy concerning the appropriateness of industry tend to be associated with those industries engaged in the manufacture of wood products.

The need for wood products stems either from the demand for such products on the part of the domestic population or the opportunity to increase GNP and improve the country's balance of trade by servicing international markets. If the impetus to expand an existing forest industry or to introduce a new forest industry is a wish to serve an international market, then clearly the new industrial effort must be competitive with alternative sources of the commodity in terms of price and quality and be designed either to supply a new and currently unaccommodated demand or to preempt another supplier in the world market. If the thrust of the new or enlarged enterprise is to meet the needs of a domestic market, then the need to be competitive depends in part at least upon the extent of the protection and subsidy of local industry that is provided by the government.

(b) Are there raw-material resources available?

This might seem to be an unnecessary question but it is not. In far too many of the less developed countries too little is known about the forest sector as a source of material. National forest inventories are rare and when they exist they are often poor from a materials supply standpoint. All too frequently they are counts and measurements of trees without regard to whether these trees are useful for materials supply. Not uncommonly there is little information on the state of forest management in the country or on the fraction of the forest which is actually under management and therefore is likely to represent a long-term raw-material supply base for industry. If the industry is to be based upon an exploitation forest, then the capital investment must be limited to an amount that can be amortized over the period of the forest exploitation. If the industry is to be based upon a managed forest as a raw-material supply, then it can be amortized over a longer period.

(c) Is there a reasonable match between the forest raw material and the wood commodity to be produced?

This question is related to the previous one. The efficiency of a forest-based industrial system as a material conversion enterprise is related to the match between the forest and the manufacturing facilities related to it. If a product is projected for manufacture that will utilize a relatively small fraction of the raw material base, it may represent a waste of resource and a financially unstable enterprise. Sometimes it is wise to restrict the installation of an industry that utilizes a relatively small share of the resource until it can be paired with one or more industries than can use the non-utilized or under-utilized portion.

The mixed species/all-ages forests of the humid tropics are notoriously difficult to match with any forest-product manufacturing industry and achieve a good yield of finished product as a fraction of total stem volume. To obtain good efficiency of product yield from such a forest typically means that the forest must be served by several different product lines, one of which must be relatively indiscriminate with respect to wood properties. What may be involved here may be the problem of achieving an appropriate mix of industries. One difficulty with this type of forest is that, with the exception of a fuelwood operation, the industries that are species-indiscriminate, such as pulp and paper or fibreboard, generally involve very large factories and are capital-intensive.

(d) What technology options are available?

There are usually several choices of technology available to a new or expanded industry. Some technologies or combination of technologies may be more appropriate in a less developed country than others. In a

country where local capital is limited, a choice of technology that does not require extensive and expensive foreign financing may conserve in-country some of the value added in manufacture. Technologies that are labour-intensive may be more appropriate in countries where there are large supplies of low-cost labour. Energy conservation technologies are attractive to countries whose major source of technical energy is imported fossil fuels. Technologies that permit use of wood fuel in substitution for fossil fuel may be even more acceptable.

(e) Are there human resources available?

It is important in assessing the appropriateness of a forest industry for development to determine the availability of labour to undertake the various tasks that must be performed in the conduct of the business of the industry. These tasks may range from the general management of the business or of the factory to unskilled labour such as is required for sweeping the floor. The availability of adequate human resources may be of critical importance.

A study of the frequency of various skill levels for four different forest-products industries (linerboard, newsprint, particle board and lumber) indicated a very substantial agreement on the distribution of workers by skill level. Contrary to conventional wisdom there was little basis for choice among industries on the basis of technological, organizational and judgemental personnel requirements. Within each of the industries there was variation depending upon the technological sophistication of the particular installation. This study also inquired into the amount of education and training required to develop a work cadre for the industry with the requisite skills, assuming a base skill level in the general population of the sort represented by the ability to operate a truck or tractor and carry out the basic maintenance on such a vehicle. This study revealed that between 32 and 43 percent of the general workforce would have to be given additional training to provide the proper mix of skills.

If the general labour pool has a much lower basic skill level, obviously the fraction requiring additional training will be much higher. For example, a new type of technical industry can be introduced much more easily into a society that is used to owning and operating automobiles and motorcycles than into one where the principal vehicle is an animal-drawn cart or wagon.

If a labour pool is seen to be too poorly skilled for the industry, the use of large numbers of expatriates may be required and this may not be consistent with the country's social objectives. One way to improve on such a deficiency is to provide education and training programmes at all levels, for the industrial skills required by industries in anticipation of industrial expansion. It is particularly important that this education and training be provided to rural residents since this is where most forest-based industries are located. It is important that this training encompass the whole range of forest system activities from forest through factory. This may be the most important method of implementing the principles adopted by the World Conference of Agrarian Reform and Rural Development (WCARRD) as far as forestry is concerned. If there is a choice between downgrading the technological level of an industry to match an unskilled population and upgrading the skill level of the population to match the technological needs of a sound industry, development is better served by the second choice than by the first.

9. CONCLUSIONS

In any specific industrial development project a balance must be struck between labour and machines and the proper balance will often depend upon the relative availability and cost of capital, energy and qualified labour. Industrial projects established in less developed countries, that are carbon copies of successful capital- and energy-intensive projects in developed countries, have usually been failures. There is no merit in a project that invests hundreds of thousands of dollars in an elaborate mechanized log deck for a sawmill when with proper design the same logs could be effectively and efficiently moved by hand with unskilled labour that is readily available at low cost. In the same mill, however, there could be valid reasons for using an automatic carriage setworks if this ensured manufacture of a higher-valued and more marketable product.

In any specific case, decisions regarding trade-offs among the resources to be committed to a project need not be a matter of arbitrary rules or, for that matter, emotionalism. Such decisions are a part of the task of sound factory or field operation design. There are good technological procedures available to project designers that will lead to sound decisions in this domain. One method of making a quantitative analysis of man-machine systems using graphical techniques was presented to the FAO/SIDA Consultation on Intermediate Technology in Forestry held in India in 1981 by Professor Ulf Sundberg of the Royal College of Forestry, Sweden. Similar kinds of comparisons can be performed mathematically. Such analytical procedures may not take into consideration all of the factors of concern in the choice of technology, but they are useful in assessing the cost of adopting sub-optimal industrial solutions for social or political reasons.

Technologies that utilize skills that are present in the domestic population may be preferred to those that require the use of expatriates, at least in the early stages. This helps local employment and also conserves value added in manufacture.

The less developed countries are becoming increasingly concerned about the impact of industry upon the environment; quality of air, quality of water and quality of soil. Some technologies are clearly less acceptable than others from the standpoint of their adverse impact upon air, water and soil. Often these are the processes that are technically and scientifically more sophisticated.

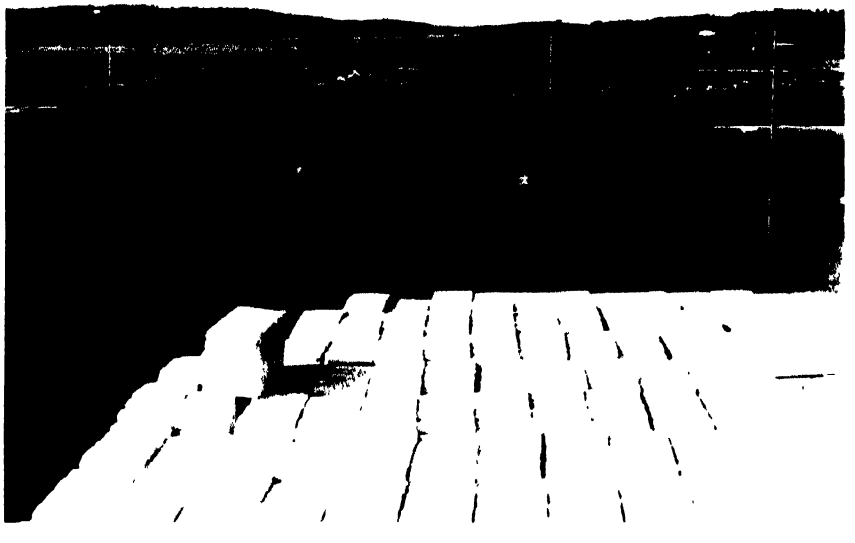
If there is no expansion of industry or introduction of new industry there is no development. One price of industrial development is some level of social stress. The faster the expansion, the greater the stress. It is a matter for the society itself to determine whether it wants the advantages of rapid development and is willing to pay the price in increased social impact. There is no painless development.

Generally, the question of the appropriateness of a forest-based industry is raised either in the context of industry involved in the exploitation of natural or secondary forests or industry that forms a part of a production forestry system. But there are also needs for the development of small industries to be used in the managed utilization of protection forests. These are the forests that are managed primarily to provide protection to soil, water or biota, but are used by residents of the local communities to yield forest products for local community development consistent with the primary protection role. This may involve fuelwood or charcoal production operations, pit-sawing or hewing to obtain lumber or timber, collection of thatch, the growing of edible mushrooms and similar activities designed to meet the needs of local forest dwellers.

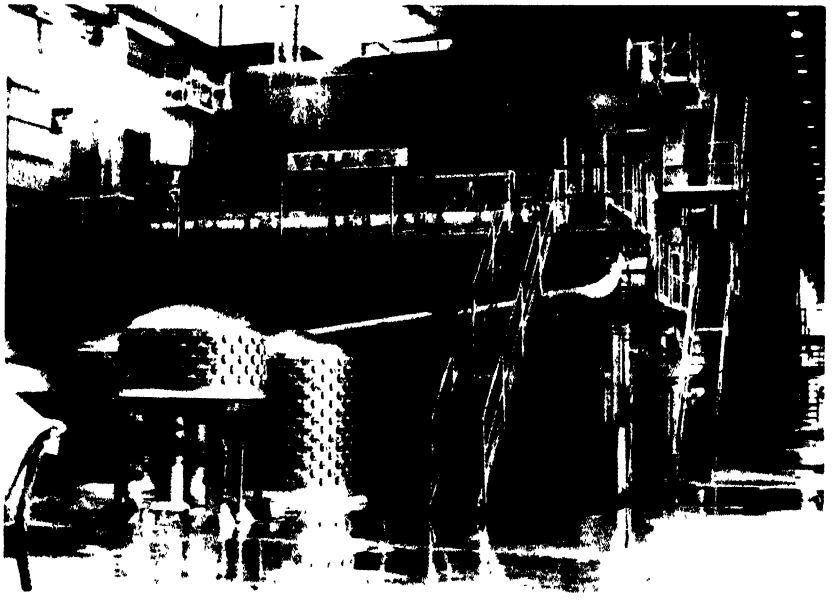
Often the needs of these producers of products are not considered in the development of appropriate industries. But they should be included in industrial development planning because they often represent that portion of the population frequently referred to as the rural poor and they help meet the essential needs of other rural poor. Not uncommonly these members of society are productive at a very marginal level and earn only enough from their labours to meet their minimum needs for food, clothing and shelter. For the fuelwood producer, a way to log, crosscut and split trees that is better than an axe may permit him to increase his daily productivity and thus his income so that he and his family can enjoy a better way of life. For the fuelwood cutter this could be development. Similarly, the introduction of modestly better tools can make a major developmental improvement in the way of life of a small-scale furniture craftsman or a maker of brooms or boxes and crates.

The development of these small-scale cottage type of industries may be particularly important in the less developed countries where many forests are multi-species, all-ages hardwood stands occupying very fragile sites. It is very difficult to base a sizeable production forestry system on such a forest because of the cost of extraction of large volumes of wood. In these forests where protection of the forest may be the primary concern of the whole society, the highest and best use may be cottage industries which serve local communities. The development of industries and technologies that are appropriate in protection forests may well command a very high priority in the formulation and implementation of a forestry-based development strategy.

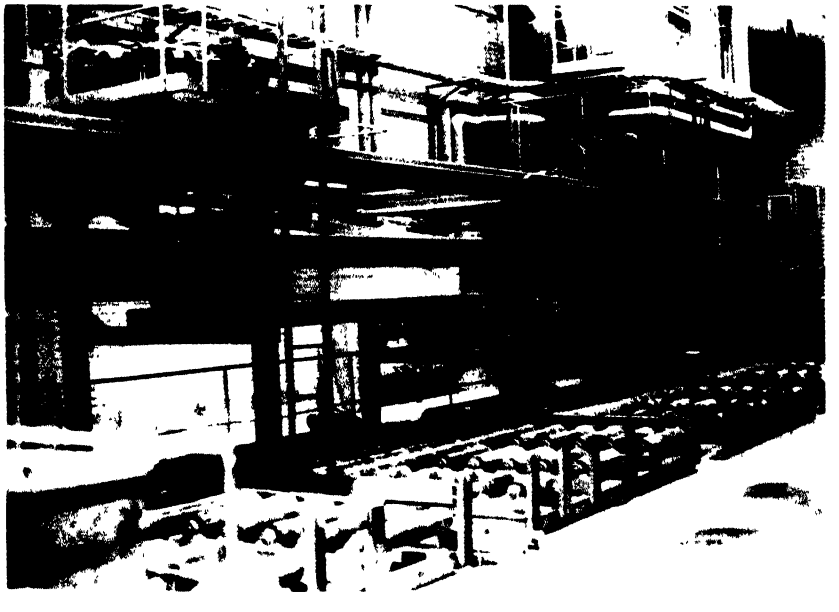
What is generally least acceptable of all is an industrial development that imposes an adverse social impact upon many people while bringing a favourable developmental impact to a few. It is generally the role of the government to strike a proper balance between the costs and benefits.



Pulp bales waiting for shipment (in background pulpwood storage) (Photo: H. Seppanen)



Wet end of a paper machine (Photo: H. Seppanen)



Sorting station for wood based panels
(photo: H. Seppanen)

DEVELOPMENT PLANNING

by

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1. INTRODUCTION

In industrially advanced countries with a strong private sector and well-developed markets the aim of government planning is to achieve, within the limits prescribed by the need to maintain economic stability, a level of effective demand which allows full utilization of capital stocks, labour force and resources in general. This is called anticyclical planning and is intended to even out fluctuations in supply and demand and to increase the rate of income. However, the direction of growth is left to the private sector and such planning does not attempt to involve public investment to accelerate the rate of growth. Its purpose is not to stimulate growth but to ensure that the growth rate does not expand at the expense of economic stability, jeopardized through inflation or difficulties in balance of payments.

A prerequisite for anticyclical planning is that the existing institutions for social and economic progress are adequate and that they operate with acceptable efficiency. There should not be an undue imbalance in the distribution of land, property and incomes. In addition, government administration needs to function well and the private sector to be well developed.

Most developing countries, however, do not meet these prerequisites. They usually have unemployed or underemployed resources, balance of payment difficulties and a variety of bottlenecks which hamper production and distribution. The distribution of incomes is usually heavily askew, government machinery is often inadequate and the private sector is reluctant to expand its productive capacity or unable to do so due to lack of sufficient financial resources. Foreign investment is often limited to the extraction of natural resources for processing abroad. The purpose of planning in these countries is to break down structural obstacles which hinder growth. This is called development planning, which goes farther than anticyclical planning and aims at accelerated economic growth and structural change in the economic conditions, for instance through development or strengthening of institutions.

Development planning can be multinational, national or subnational; it may refer to planning ranging from a joint effort of a group of countries down to planning in a region within a country. The development plan of a country gives the framework within which the government intends to provide economic and social development through implementation of the sector plans from which the overall plan has been established. The development plan, therefore, makes provisions in a coordinated manner for government investments or guarantees for loans, amendments and changes in regard to legislation, improvement and establishment of institutions as required for the various sector plans.

Although development planning usually encompasses all sectors of economic activity in the target area, it is often questionable whether a plan with very wide objectives will be implemented. A far more realistic approach is therefore to concentrate the effort on a number of partial development plans which each relate to one sector only, that is, sector

plans. In the following chapter the emphasis will be on sector planning as a more feasible approach to development planning. Project planning, which follows sector planning, will not be dealt with in this context but introduced during subsequent lectures.

2. THE BASICS

2.1 Definition of some terms

Confusion often arises because certain terms are misunderstood as they may mean different things in different contexts. Some of the terms used in the following text may therefore need defining.

Objectives are formulated by governments and are therefore based mainly on political considerations.

Goals and targets interpret the political objectives in physical and quantitative terms.

Policies and strategies indicate how the objectives, and the consequent goals and targets, are to be achieved. They are formulated by the executive agency, e.g., in the case of forest sector planning, the forest service or another related institution.

Policy instruments and measures are the tools, such as legislation and taxes, employed to pursue the policies.

Programmes, projects and activities are the concrete elements which translate plans for achieving objectives into actual development.

2.2 Types of planning

In the introduction it was stated that development planning aims at accelerating economic growth, which implies quite serious intervention by the government. However, the government need not have detailed control of all decisions, although it would exercise conscious control or direction of the economy. The degree of governmental control over the economy in a country will affect the type of planning adopted. Three main types can be distinguished:

Directive planning, in which instructions are issued by the planning agency to the individual economic units. This type of planning is found in some fully planned socialist economies.

Indicative planning, where the planning agency merely defines the allocation of resources which would be necessary to achieve certain objectives. It is left to the individual economic units to decide whether or not they will act upon it.

Incentive planning, which devises the provision of certain economic incentives to make the planned course more attractive to the economic units which could implement the plan.

Indicative and incentive planning are most commonly found in market economies where the resources are allocated to a large extent according to the expected profitability of the projects included in the plan.

Since most economies nowadays are mixed, it follows that planning most often is a mixture or combination of all types.

2.3 Time horizons in planning

Planning always refers to a certain period of time and one can broadly distinguish between a long-term or perspective plan, a medium-term plan and a short-term plan.

The purpose of a long-term plan is to establish a broad outline of what is expected to, or should, take place over the time period considered. In this way a framework is provided within which it can be decided what should be done in the more immediate future. The medium-term plan, and especially the short-term plan, present this in more detail.

The long-term plan points out future requirements with regard to institutions, legislation and long-term investments, whereas the medium-term plan is primarily concerned with changes in policy, techniques and medium-term investments. Short-term plans, for instance annual plans, deal mainly with allocating resources to the work that needs to be carried out.

Although this is all very neat in theory, there may be considerable difficulties in linking together the plans for the three different kinds of time-span. There is accordingly a need for considerable flexibility in long-term planning so that it can be adapted as the assumed scenario is found over time to change. This holds true also for medium-term plans, so in practice short-term plans may exert a strong influence on the others.

2.4 Levels of planning

Planning does not only refer to a certain time horizon, but also recognizes different types of planning within the economy. A distinction is therefore usually made between three different levels of planning: macro or overall economy level, sector level and project level.

Macro planning is concerned with national aggregates of population, investment, savings and foreign exchange, and sets development targets for the economy as a whole.

Sector planning deals with specific areas of production, such as agriculture, forestry or forest industries, and analyses their role in meeting the targets of the macro plan. It sets sectoral goals consistent with the macro plan and defines policies and activities needed within the sector to achieve these goals.

Project planning deals with the identification and appraisal of the specific units which will translate plans into reality. The project plan constitutes the bricks which together make up the building of the sector plan. Success in implementing both macro and sector plans accordingly depends to a large extent on the success achieved in identifying, preparing and implementing the individual projects.

3. THE NEED FOR PLANS IN THE FOREST INDUSTRY SECTOR

In a very general way, it can be said that the need for a sector plan arises from one of the following three causes:

(a) There is a general wish by the government to utilize to the fullest extent the resources available in the country to create employment, stop people from migrating to urban areas or contribute to development in general. In such a case, the plans usually concentrate on the establishment of new forest industry

units and the existing industry is taken into account only to the extent that it affects the general supply of goods to the market and the consumption of raw material in a certain forest area.

(b) The government makes a conscientious effort to increase the value added to the forest industry products exported and/or to substitute imports by establishing processing facilities within the country. For instance, log export may be substituted by export of sawn goods or plywood. The approach to planning as regards the industry already existing may be similar to that mentioned in the previous paragraph. However, if the existing industry in the past has been geared mainly toward the domestic market, the plans may include its expansion or modernization.

(c) If there already exists a fairly well established forest industry, partly serving the domestic market, partly for export, but due to a changing economic environment (for instance, if the country is expected to join a common market area in the foreseeable future), the government wishes to strengthen the competitiveness of the industry, the emphasis in planning is strongly on the existing industry, although establishment of new industries may also be considered.

Needless to say, there may sometimes be combinations of two or all three of these types of planning in practice.

4. GETTING STARTED

4.1 Organization of planning

The main responsibility on an executing level for forest industry sector planning usually lies with an organization such as the Forest Industry Corporation of the country. However, since planning needs to take into account a number of political issues, governmental objectives and overall development targets, involvement is usually expected from ministries, most obviously the Ministries of Industry and Agriculture/Forestry, although other ministries may be required to contribute as well from time to time.

From this it follows that in addition to a team of planners, with or without the aid of outside consultants, there is a need for a forum for discussion of the plans as they develop. Such a forum may take the form of a steering committee with representatives from other government organizations and, preferably, industry as well. This is partly to ensure acceptance of the recommendations of the final plan by all parties concerned, but also to call upon the assistance of other organizations when required and to ensure that it is given. For instance, the Ministry of the Environment may have to be involved in evaluation of the proposed plan and to provide guidelines for pollution abatement measures which will be required, if such guidelines do not already exist in a sufficiently elaborate form in the country.

4.2 The phases of planning

The phases of sector planning in forest industries are usually as follows:

(a) Definition of the planning period(s). The plan may refer to an overall planning period which is too long to provide meaningful directives for the timing of implementation of the projects included in the plan. For this reason, the overall plan may be divided into a number of planning periods, say, five years each.

(b) Preparation of a work plan. In addition to the activities required to be carried out, this work plan should also include a timetable for meetings of the steering committee in order to show the extent to which this will be called upon to provide comments and inputs to the planning exercise.

(c) Collection of data. This does not refer only to collection of basic data such as those on forest resources, technology available, products to be considered, markets, etc., but also to important background information such as constraints on utilization of certain forest resources (for instance, special forest ownership conditions in that area or in the country) or threats from outside competition. In some cases it may even be necessary to study the conditions in other countries with more developed forest industries to see if lessons can be learned from the strategies they have applied.

(d) Processing of data. This does not mean only data processing on a computer, which might or might not be applicable, but also more general data analysis.

(e) Identification of projects under the sector plan. This includes identifying locations (not sites) of production units, size of production of given products on each location, investment required for each project, and manufacturing costs.

(f) Evaluation of projects under the plan. Such an evaluation does not by any means replace the prefeasibility study or feasibility study which will eventually be required before the implementation of the plan on a project level. However, it provides a preliminary screening of projects so that the plan in principle, at least, will include only projects which potentially will be feasible under the criteria applied, financial, social or other.

(g) Identification of constraints to be removed. Such constraints can be legal, or relate to infrastructure, customs tariffs which affect the cost of certain raw materials or import of machinery to establish the industry, not to mention constraints on import of spare parts which often seriously affect the efficiency of existing industries and will affect those to be established in the future.

(h) Identification of incentives required. These may relate to granting government loans or guarantees for loans, grace periods and special rates of interest, tax exemption during the initial years or special depreciation allowances, provision of certain cost inputs at subsidized rates (for instance, power), special customs tariffs for import of competitive products for the initial years of operation, etc.

(i) Presentation of the plan.

5. PREPARATION OF A WORK PLAN

It would require too much space to go into the details of preparing a work plan for a sector study in this context. However, it may be worthwhile to point out certain pitfalls and emphasize some important points. The following therefore applies regardless of whether the work

plan consists of a network chart, a bar chart or a general tabulation of activities with dates and deadlines included.

The most common mistake in preparation of work plans of any kind is that insufficient time is allocated to the various activities required to prepare the plan. This is especially true for data collection and their analysis or processing. The priority given to the work by cooperating organizations may also be overestimated, so that waiting for the inputs from organizations not directly concerned with the overall preparation of the plan may turn out to be a critical factor. It is therefore important that sufficient time is allocated to activities not under the direct control of the executing organization or of the working group responsible for the preparation of the plan.

Meetings of the steering committee need to be sufficiently clearly flagged in the work plan and the purpose of each meeting defined. For instance, it is not sufficient to give the date alone of the meeting, such as "September" but the plan should make a statement such as "September - Meeting of steering committee to define priority of projects for implementation".

Allocation of time for an activity must also take into account the number of staff in the executing working group. This may seem self-evident, but very often the staff of a working group for a plan is assisted on a part-time basis and their regular supervisors may suddenly decide that other work has higher priority. It is therefore unrealistic to assume under such circumstances that the working group will be fully staffed throughout the planning exercise.

6. COLLECTION OF DATA

Ideally, the persons allocated to the collection of data should also be responsible for actively analysing and processing all inputs as a team. In practice, however, data may have to be collected and supplied by provincial offices who often do not know what the purpose of the exercise is. The best approach is to have the working group staff visit the sources of data in person. Sending out questionnaires in advance does not usually serve the intended purpose.

If data are not available at the first visit, relying on a promise that they will be sent next week is very seldom sufficient, even if the dispatch consists only of mailing a stack of documents already provided during the visit. It is usually better to accept carrying a few kilos of documents back, even if this means a certain amount of inconvenience. If copies of documents are promised in the near future, a follow-up is usually needed to ensure that they are actually sent and the ideal follow-up consists of giving a date for a second visit, when the documents will be picked up.

In the collection of data it is extremely important that the office contacted is informed in sufficient detail about the purpose of asking for the information. The type of data asked for also requires specific attention. For instance, it is obvious that forest inventory data need not be absolutely up to date, whereas information on transport costs and raw material and product prices needs to be as up to date as possible, and preferably supported by evidence in the form of copies of invoices.

The data required for a forest industry sector plan usually relate to the following items:

- Resource information such as geographical location, area, growing stock, annual allowable cut, plans for plantations or if land would be available for establishment of plantations, present utilization of resources by local population and by industries, ownership pattern, etc.;

- Logging and transport costs for wood;

- Availability of other raw materials required for manufacture of forest industry products, such as chemicals in the country, or ports of import if not manufactured locally;

- Price of raw materials and unit costs of transport;

- Cost of other manufacturing inputs, such as wages and salaries, electric power, etc.;

- Possible locations of production units for different types of forest industry products, and requirements on development of infrastructure;

- Location of existing forest industry units and their capacities (possibly also their general condition and potential for modernization and expansion);

- Overall market (domestic and/or within the target export areas), market size in consumption centres, market price of products and cost of transport of products, both inland and by sea if export is considered;

- Quality requirements for the products by different markets.

The above list is by no means complete but shows the basic data required for practically all forest industry sector planning.

As already mentioned, depending on the type of projects included and the local conditions, information very often needs to be obtained on social, legal and political matters which may affect the implementation or the success of the projects which will be proposed under the plan.

7. PROCESSING AND ANALYSIS OF DATA

The first step, once all the background data have been collected, is to review the information in a coordinated manner; preparing maps of resources, market centres, possible mill locations, etc., so that the material can be more easily understood as part of the background against which the plan will eventually be formulated.

The market information will provide an overview of what possible products can be sold, where, in what quantities and at what price at present and in the future. A preliminary comparison of this information with the data on present and future resources, the possible production locations and the distances between these various centres already provides a preliminary screening of the possible projects which can be included in the plan. Although this may sound simple enough, the effort involved may be considerable.

On the basis of the above screening, the number of resource areas, production locations and market centres can be reduced to a more easily manageable amount of material to start the preparation of a forest industry sector plan.

8. IDENTIFICATION OF PROJECTS

Once a preliminary screening of the data material has been done, with or without the aid of a computer, the projects which might be included in the plan, at least for preliminary consideration, can be considered. Thus the products which could be manufactured can be identified, together with possible mill locations; and what remains to be done at this stage is to determine the actual quantities of each product which would be produced at each location, following which the investment requirement needs to be established, together with the cost of manufacture and the mill net price which can be obtained for the products in each case. The cost of transport of raw materials and products needs to be taken into account and this involves a fair amount of optimization, preferably carried out by computer, unless the number of variables is minimal.

This stage of the work already involves a considerable amount of evaluation of the projects and in fact it is very often combined with the next phase of the planning exercise.

9. EVALUATION OF PROJECTS

The purpose of evaluating the projects identified in the screening exercise is to provide a means of ascertaining that the projects to be included in the plan are viable according to the criteria given. The criteria may be financial, or relate to macro-economic considerations such as creation of employment, general development of a specific area in the country or foreign exchange earnings. Several criteria may be used in stages in this evaluation process, for instance, evaluation based purely on foreign exchange earnings in relation to the foreign exchange requirement in investment, setting a minimum limit for acceptance. The projects selected according to this criterion are then subjected to an evaluation based purely on financial returns, say, a minimum internal rate of return of 15 percent.

In the above example, the target is obviously mainly the best possible returns expressed in foreign exchange. Other considerations would call for a different evaluation by stages.

Another feature may be that in the list of projects arrived at after the step by step screening, there may be too many projects or their total investment requirement may be too high. Then either the screening can be repeated according to the same criteria, using higher minimum limits for acceptance, or new criteria in the evaluation process can be introduced.

If several planning periods are used, say four periods of five years each, it is usually preferable to start with the most remote period, in order to arrive at a complete list of projects which would be included in the plan as a whole. Any project that would not be included in this first listing would be excluded in any one of the previous planning periods as well. Thus a first total screening has been arrived at.

Continuing the evaluation and selection of projects by planning periods backward, a breakdown of the projects is obtained. In the final list, the projects already included in the earlier planning phases are removed from the subsequent ones.

10. REMOVING CONSTRAINTS AND PROVIDING INCENTIVES

Once the final list of projects for the various planning periods has been arrived at, it is necessary to return to the original background information obtained during the data collection phase. It may then be found that there are some constraints which would affect the implementation of one or several of the projects. If these constraints are insurmountable, a mistake has been made in the preliminary selection of projects, or that selection was made in such a way that these constraints could not be taken into account. In any of these two cases, the projects affected by these constraints would have to be removed from the list and it may be necessary to re-evaluate the projects and prepare an entirely new list.

The constraints normally relate to political, legal, institutional or social issues. In the presentation of the projects, they have to be pointed out and suggestions made as to how they can be removed.

A constraint may also relate to a cost input which is artificially high and for that reason has been shadow priced in the selection and evaluation phase. For instance, the cost of power in the country may have been set very high for political reasons to discourage wasteful use of electricity. Introducing an industry which requires far more energy than any of the existing types of industries may need granting lower power tariffs to this industry as a high consumer. Another related example may be that power generation by the mill combined with purchasing power from the national grid is not allowed by the authorities, and thus may require a change in regulations or legislation.

The borderline between removing constraints and providing incentives is diffused, as can be seen from the above examples. However, direct incentives usually relate to customs duty exemption for import of equipment in the construction phase, protective customs tariffs for the products, loan conditions and taxation.

The government may provide very favourable conditions for loans to a project if it fits into the overall development objectives of the country. The extreme of this type of incentive would be to provide the required infrastructure free of cost to the project. This can be justified if the infrastructure contributes significantly to the development of a backward area and will serve a number of other projects as well in the future. However, more commonly granted incentives of this type relate to the grace period for loans and the rate of interest applied on the loan. The rate of interest may be low throughout the loan period or it may be lower than normal only for a specific number of years, until the industry has established itself firmly.

Incentives which relate to taxation may consist of tax exemption for the initial years of operation and/or special depreciation allowances for a new company so that its taxable income is reduced. The possibility of carrying forward losses from previous years, combined with depreciation allowances, may provide a very useful incentive.

Whatever the incentive provided, it should be clearly understood that they would always be granted for a limited period only. Granting of incentives for an indeterminate period leads to what is commonly known as 'featherbedding' so that the enterprise does not make the expected efforts to be economically efficient without the incentives.

11. PRESENTATION OF THE PLAN

The following should go without saying:

- Although the plan may be supported by a large number of detailed reports and tables, the final report must be comparatively concise and have an executive summary to ensure that it will be read and understood by all at decision-making levels.

- It is not sufficient to send the report to the authorities concerned with a covering letter. Meetings will have to be convened to present it and visits paid to some offices to ensure that the appropriate, expected action will be taken.

12. THE NEED FOR REALISM AND FLEXIBILITY IN PLANNING

Quite often plans are drawn up but not implemented. The reason for this has usually been lack of realism in the understanding of what can be achieved within the time frame given, but a number of other factors may have negatively affected their implementation. These may have been political, institutional, financial or physical.

To emphasize the need for realism in the preparation of a sector plan, the following may serve as an example:

A sector plan might finish up with a set of projects, ranging over the opening, harvesting and management of existing forests; the establishment of new forests; the allocation of forest land to other uses and associated timber salvage operations; the expansion, modernization and phasing out of existing forest industries; the establishment of additional or new industries and associated infrastructural, social and institutional improvements, all matched to the nature, location and capacity of the forest resources, the capacity and the characteristics of the market; the technological capacity of the various communities and their social and cultural needs, as well as governmental objectives.

A plan like this is no doubt very comprehensive but has the disadvantage of trying to reach an ideal target. In order to implement it a number of agencies would of necessity have to be involved, and increasing the number of decision-makers who would have to be at least consulted slows the implementation down. In most cases such a plan would have to be abandoned or adapted, however perfect it initially seemed on paper.

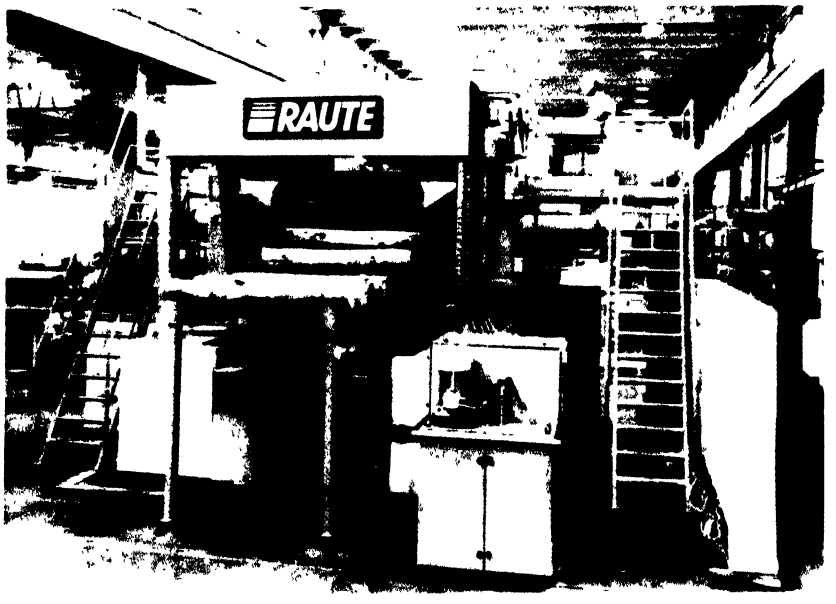
The above example serves to emphasize the point that a plan, to be realistic, needs to have as many components of implementation as possible under the control of as few institutions and decision-makers as possible. The more projects a plan covers, especially if they are of a great number of types, the more likely it is that the plan will soon have to be amended and/or eventually abandoned. It is accordingly in the interest of realism to try to limit the number of projects in a plan, for instance by reducing the geographical area for which it is to be prepared.

Plans are usually made against the background of a certain expected scenario, be it economic, social, political or physical. Although the assumptions made at the time the plan was prepared seemed to be correct, there may be significant changes in the actual scenario during the implementation phase or changes in this regard may start developing. If the plan is irreversibly tied to the assumptions made in the original scenario, such as policies, activities and investments, which with time turn out to be wrong, the targets aimed at in the original plan will not be achieved. A 'must' in a well prepared plan is therefore a sufficient amount of flexibility.

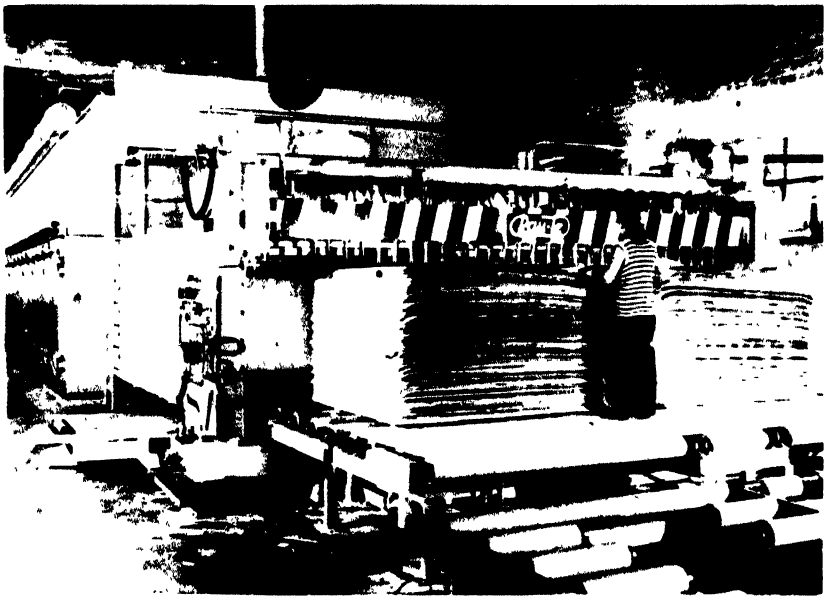
The need for flexibility clearly creates problems in large-scale forest industry projects, which need a certain time frame for financing and implementation. This is especially true for forestry projects which by their very nature require a long-term view. An investment in a forest plantation cannot be recovered for reinvestment in what is later seen to be a more appropriate development until the trees have reached maturity - and even then only if there is an outlet by that time for the particular crop raised.

When forest industry plans are based on existing resources, a certain amount of flexibility can be inherent in the plan. This flexibility can even be considerable for small-scale industries. However, if the industrial plan is based on the establishment of resources in the first instance, it may be that a resource is established at considerable cost for industrial projects which eventually may not materialize. The reasons for this may be that the industrial projects in the end were deemed unviable, the expected markets did not materialize, there were changes in the overall scenario, or simply that financing for one reason or another could not be raised. It is accordingly important that the flexibility of the overall sector plan is already sufficiently great in the first stages of implementation, so that the plan can be modified to meet the requirements of the changing scenario.

To mention a simple example: If the plan originally envisages the establishment of large pulpwood plantations for construction of an export pulp mill in the second phase, developments should be reviewed from time to time during the first phase. In this way the resource can, if necessary, be developed for establishment of a sawmill instead, if changes in availability of financing, markets, prices, or other assumptions originally made warrant this.



Peeling lathe with centering device (Photo: Raute Oy)



Infeed of veneers into drayer (Photo: Raute Oy)

MANAGEMENT SYSTEMS AND TECHNIQUES

by

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1. INTRODUCTION

Management systems include a broad variety of activities that are used in business and industrial organizations. Because there are no clear boundaries for them, they can include practically whatever management exists in those organizations. This would also be true for systems covering, for example, time, remuneration, cash-flow, finance, raw materials and sales.

In this paper management systems are described from the standpoint of managing organizational development and systems connected with it.

2. A THREE-ELEMENT APPROACH TO MANAGEMENT SYSTEMS

To handle a topic as broad as management systems, it will be useful to represent the systems in a condensed form. For this purpose a schematic approach will be found below consisting of only three major elements (Fig. 1).

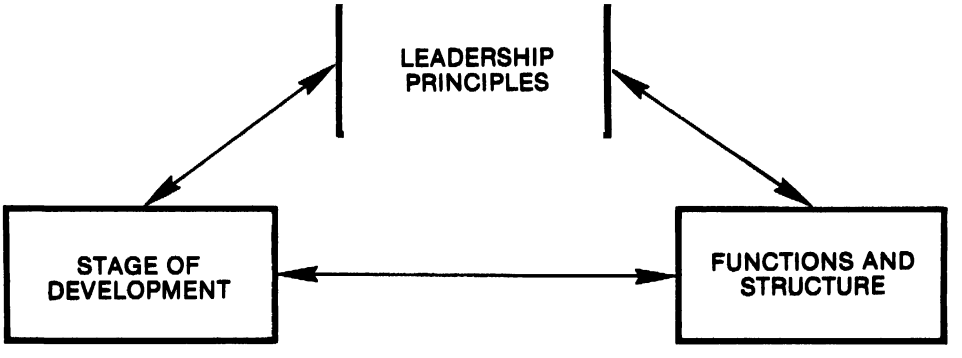


Fig. 1. ELEMENTS IN MANAGEMENT SYSTEMS

The first element of management systems stems from the human qualities of the management itself: how do the managers think and act? what are the objects of their interest and strivings? Is there general agreement on the way to run the organization? A detailed example of this element with local experience is given under the heading Leadership principles and management techniques, section 3.

The stage of development refers to the long-term situational factors faced when running an organization. This type of element is present when technology changes rapidly and when there are major changes in society and its members. Development of attitudes and training of subordinates

can also be the source of a new stage in this element, as well as the effects of changing markets. This element is covered by the heading Stage of development of an organization, section 4.

The element of function and structure in organizations stresses, for example, how tasks and responsibilities are distributed; what are the ways and methods of budgeting and planning; and how to control, direct and reward personnel. It explains the systems for negotiations, distribution of information, training and development methods. This element is handled in more detail under the heading Functions and structure of an organization, section 5.

3. LEADERSHIP PRINCIPLES AND MANAGEMENT TECHNIQUES

3.1 Leadership principles

Leadership principles were for a considerable time in the past based on the assumption that leadership was a quality of almost divine origin. During that time it was important to identify the leader, convince others that he was a leader and finally give him paramount power over others. Because he had total power, he made the rules to fit his own ideas best.

In contemporary organizations this situation is no longer common because there are many other sources of power to be dealt with; for instance, qualified personnel, financial and economic limitations and legislation. Leadership principles are usually reflected by acceptable general rules, like company policies. These policies imply the basic methods to be used to lead and give various degrees of freedom to each manager or superior to exercise leadership in his or her field of work.

Leadership principles in organizations can be described briefly with the concepts of "authoritarian" and "democratic". Authoritarian leadership is based on the use of power and social distance between the superior and the subordinates. It reduces upward communication, decreases initiative-taking on the part of the subordinates and minimizes their personal involvement in the tasks which are allocated to them. Direction is the keyword in exercising authoritarian leadership. Democratic leadership, on the contrary, stresses the participation of the subordinates in decision-making, and the expression of viewpoints on matters which relate to their work.

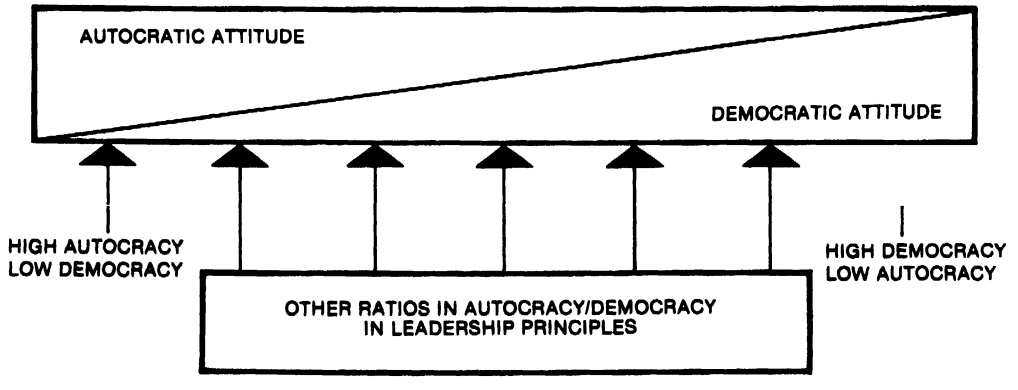


Fig. 2 AUTHORITY AND DEMOCRACY IN LEADERSHIP (ADAPTED)

During the nineteen thirties it was thought that these two principles of leadership were exclusive, but it was soon shown that they can be used at the same time.

Fig. 2 is a representation of leadership principles with different degrees of authoritarianism and democracy as described by Tannenbaum and Schmidt. The figure shows that there are many combinations of authoritarian and democratic leadership which can be used by a superior at work. Present-day leadership principles are, to a certain degree, combinations and they are perhaps closer to the right side of the figure than to the left.

3.2 Management techniques

Management techniques can be grouped according to what aspect they stress. They are often developed from more general leadership theories as practical methods. They may occasionally overlap; they do not always include each other. The choice of which to use depends on the stage of development of the organization and its culture. (This will be discussed later in sections 4 and 5).

3.2.1 Human task orientation

Improvement of managerial skills and abilities are essential in developing the overall performance of organizations. There is a need to show managers at all levels that there are some typical ways to perceive the organization as both a collection of individuals (subordinates) and a collection of tasks.

Managerial effectiveness is reflected by combining these views and increasing performance. This technique has a close resemblance to leadership principles in the sense that human orientation is related to democratic leadership and task orientation is close to the authoritarian type. The best known method of improving managerial skills in this regard is called the "managerial grid" technique, developed by Blake and Mouton. When situational factors other than the basic orientation are stressed, then, for example, Reddin's 3-D technique could be used.

3.2.2 Management by objectives

Management by objectives (MBO) can be used as a specific technique for evaluation or as a complete management system, or anything between these extremes. It was first introduced by Drucker and is based on setting individual objectives according to an organization's key areas and making evaluations from the results. There is a wide variety of ways to use the MBO techniques. The organization can decide how much contribution and communication is necessary between its members in different stages of MBO as well as what types of action should be taken regarding the results. The advantage of this technique lies in its flexible application and its undoubted improvement of decision-making. It focuses on relevant areas of work, sets up feedback and communication between the superior and the subordinates, and builds up a clear control system. However, it needs special training, occasional consultation on implementation and dedication.

There are some other disadvantages in MBO which depend on the organization in question; for instance, increased paperwork, excess standardization of superior-subordinate communication, too little room left for matters outside the appraisal and even worsening of the relationships between individuals or parts of the organization, but because of its advantages MBO is widely used in business, industrial and non-profit organizations.

3.2.3 Development of qualities of the manager

This technique aims directly at selected individual qualities of managers and leaders. A list is developed and drawn up of leadership qualities that seem important in practical exercise of leadership in organizations. These qualities are then stressed in managerial performance, and ways to develop them in managers are presented.

One example of this type of technique is the "manager's mill", a programme developed by FEMDI (Finnish Employers' Management Development Institute), (Korkala and Bergstrom). To describe the programme briefly, it relies on results based on physiological findings in brain functions. It stresses the importance in managerial behaviour of will, knowledge, perceptiveness, understanding, sense of timing and implementation. These actions are related to brain areas and the programme includes an evaluation method with recommendations. Transcendental meditation can be included in this group of techniques. Although it is more a philosophical method, it has also been used for development of managerial skills.

The relevance of these techniques in management depends on how the listed leadership qualities have been discovered or arrived at. In many cases these qualities are dependent on cultural issues, and may thus be limited. The more general the theory which can be found and validated, the broader its application.

3.2.4 Interaction and communication

Some management techniques stress the means by which communication takes place in the organization, especially on an individual level. These techniques assume that the pervading atmosphere in the organization is democratic so that everybody is willing to communicate freely with everybody else on any organizational level. It is further assumed that most of the problems imply difficulties in communicational skills or lack of knowledge on essential objectives. Openmindedness is stressed in various degrees in order to give input to interaction and the readiness to receive feedback from others. For example, in sensitivity-training methods great effort is directed toward learning the input-feedback relationship and in abolishing red-tape organizational communication. The same is done in transactional analytic methods so that communicational skills will develop. This is done mostly from the point of general psychological structure of an individual (Novey, 1976).

Interaction and communication techniques in management are popular at present because they attempt to utilize individual knowledge, experience and capacity in the organization in a coordinated way. Over and above an increase in effectiveness, these techniques greatly improve individual satisfaction in the organization. The disadvantages of these techniques are that they can be unsuccessful in communicating at more personal levels; they may be unprofitable time-consumers with no results obtained and they often forget the organizational goals in productivity.

4. STAGE OF DEVELOPMENT OF AN ORGANIZATION

4.1 Methods of defining the stage of development

Organizations have a development pattern similar to that of living things - growth ending in death - but they differ in some respects in that they resemble families rather than individuals because they can survive beyond the life of a single unit (product) or individual.

The development of an organization is normally slower than one of its particular products, although this is not always necessarily so. Some organizations flourish and fade with their products.

Organizations can renew themselves when they reach a certain stage in their development. This point can be either in the very early days of their life, or later on, or both.

There are several descriptions of development available. For example, Ansoff describes development in five stages, each stage defined with the help of seven organizational properties. Each property is given a description typical for each stage of development. For example, "attitude to risks" aims in the first stage at knowing the risks, in the second at minimizing them, in the third stage at avoiding them. (Fig. 3).

	1 DEVELOPMENT	2 GROWTH	3 RIPENING	4 SOLUTION	5 RENEWING
1. FUNCTIONAL CHARACTERISTICS		● ANTICIPATING			
2. TIME-SPAN		● NEAR FUTURE			
3. PRODUCT/MARKET STRATEGY		● CONQUERING MARKETS			
4. ATTENTION		● MARKETING ● PLANNING			
5. ATTITUDE TOWARDS RISKS	KNOWING	● MINIMIZING	AVOIDING	PONDERING	PREFERRING
6. STRIVINGS		● NEW AREAS			
7. LEADERSHIP		● RESULT-ORIENTED ● MOTIVATING			

Fig. 3 STAGES OF DEVELOPMENT AND SUITABLE ACTIONS

AN EXAMPLE ON STAGES OF DEVELOPMENT WITHIN ORGANIZATION
IGOR ANSOFF'S SYSTEM

Another method for describing the stage of development is detailed in section 4.2.

4.2 An example of defining the stage of development: organization's "biological development"

4.2.1 Natural development of an organization

The organization's "biological development" resembles the description given by Ansoff in section 4.1 but has as many as 13 critical points for analysis. It was developed by FEMDI and has been applied, for example, in forest-based industries for various sizes of sawmills and other plants.

It is important that all persons involved in management development understand one other and that they have a common vocabulary to define the current stage (of development) of the organization as well as agreement on the measures to be taken at that stage. This system gives the necessary frame of reference for business development and shows what the "natural" development of an organization would be with its anticipated critical stages (called catastrophes because they may end with the death of the organization).

The theory is represented in Fig. 4.

4.2.2 A fictitious example

The theory of an organization's "biological development" will be described by using a fictitious example. This has been incorporated in the form of a film/videotape entitled "Renew or die". (The film, which was shown, described a flying corporation).

5. FUNCTIONS AND STRUCTURE OF AN ORGANIZATION

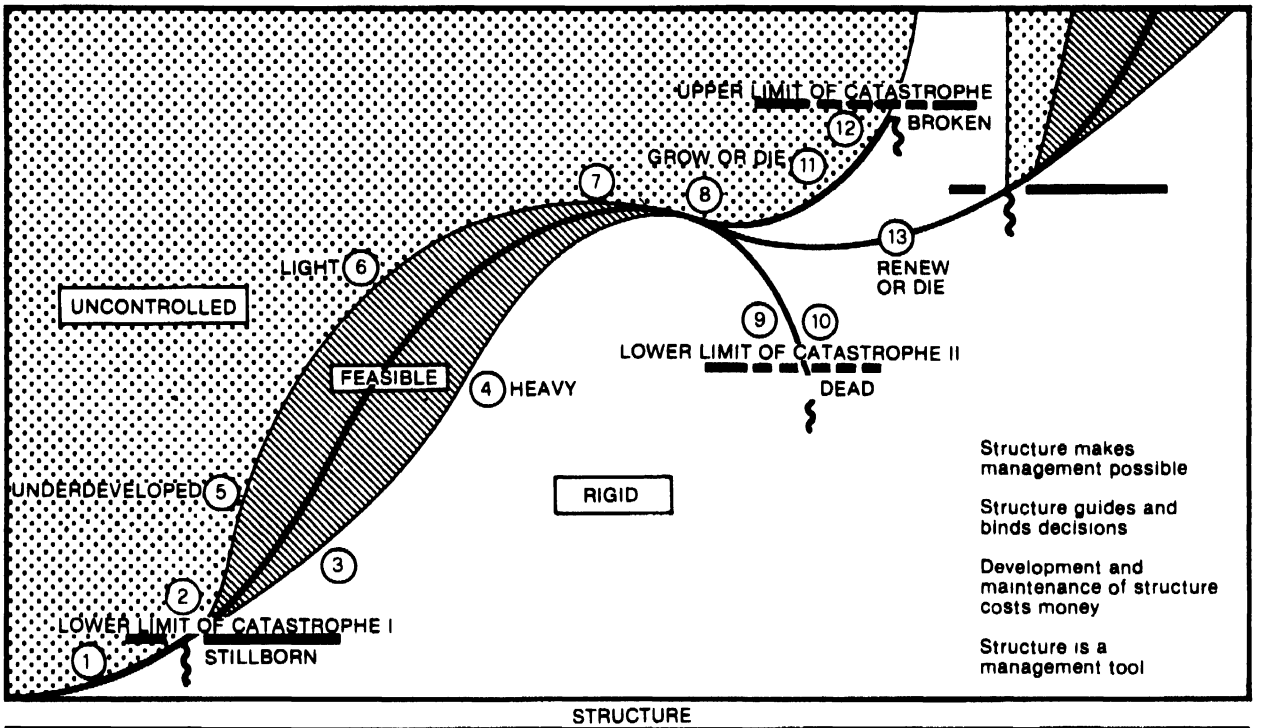
5.1 Organizations as open systems

Although rational structure of an organization is important for its proper and smooth operation, a structure should not be set up for its own sake. Structure in organizations should reflect only the functions that are deemed necessary to reach the goals set for the organization.

To classify the functions of an organization on a more general level, use may be made of the systems theories, especially the part which describes subsystems. Since subsystems of importance for organizations have a social impact, they should also take into consideration human behaviour within other functions.

The groups of functions as shown are interrelated and have common, shared areas for reaching goals. In practice, this is reflected by showing that an action occurring for the benefit of any separate subsystem affects the goal area positively only if it has positive impact on the other subsystems. Although it is necessary to increase and develop the output in all the subsystems, the overall gain of these activities depends on the state of other subsystems in that organization. Therefore, according to this approach, the most important task for management is to balance the subsystems to sufficient levels, and to cope with those forces shown as external forces.

While a complete list of these external forces is not provided they can generally be described as being of two types: interested parties and others. Interested parties are groups of people who have an interest in the organization, whether economic or social. They include groups occurring within the organization itself. "Others" includes external forces to be coped with by management, e.g. international markets, inflation, domestic competition, legislation and even climate.



STRUCTURE					
EMERGING TAKING SHAPE	EVOLVING GROWING	COMPLETE MATURE	INFLEXIBLE SENILE	EMERGING TAKING SHAPE	EVOLVING GROWING
ATMOSPHERE					
CREATIVE	STRONG	HUMAN RELATIONS IMPORTANT		CREATIVE	STRONG

Fig. 4 ORGANIZATION'S BIOLOGICAL DEVELOPMENT FRAMEWORK FOR ANALYSIS

(1) DO WE GO ON? Stop here or proceed at full speed	(2) FAILURE Resources inadequate for goal You don t reach the market	(3) TOO SLOW DEVELOPMENT Competitors are faster and occupy the market	(4) TOO MANY DIRECTORS High overall costs Activity withers away unprofitably	(5) EXCESSIVE GROWTH Skills and organization are left behind	(6) INSUFFICIENT ADMINISTRATON The management is not aware of what is happening
(7) CULMINATION POINT Everything seems to be fine it is important to keep staff happy	(8) DECISIVE MOMENT Recession in sight	(9) WITHERING You are going downward	(10) THE END The enterprise is too heavy in changed circumstances	(11) GROW OR DIE Be the greatest and finest	(12) MAMMOTH S DOWNFALL The enterprise is too large

(13) **RENEW OR DIE**

APPLICATION TO A COMPANY

Hersey and Blanchard illustrate the idea of subsystems in organizations as shown in Fig. 5.

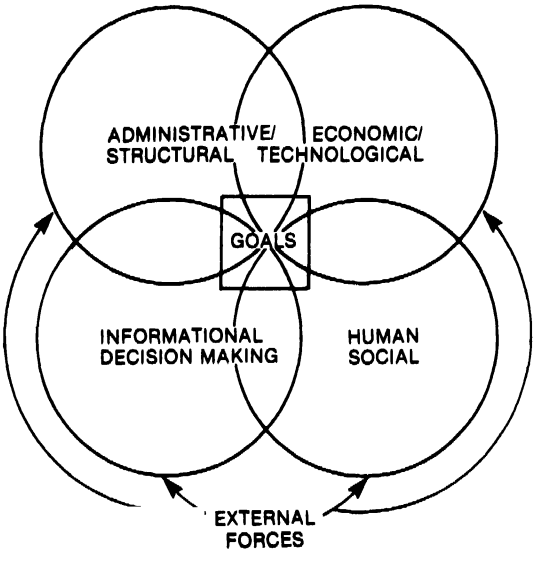


Fig. 5 INTERRELATED SUBSYSTEMS OF AN ORGANIZATION
(HERSEY & BLANCHARD, 1977)

5.2 Organization cultures

The theory of organization cultures has been selected for this paper to illustrate the relationship between individual and social behaviour on the one hand, and the structure of an organization on the other.

Organization culture refers to the overall situation in an organization. It includes the type of organization, method of leadership, motivation, principles and policies for appreciation, promotion and training. Therefore, it reflects the basic assumptions of management. There are four main "cultures" which originated in a theory put forward by Charles Handy and which was developed further by FEMDI (Handy, 1981, 176-211). The culture theory has been used widely as a tool for managements to analyse the current situation of their organizations as a whole, and to consider how some parts of the organization relate to the "main" organization culture. The theory can also be used as a method to obtain controlled change, as indicated by the external and internal development.

Special attention will be paid in this connection to explaining the typical qualities of the main cultures as stated in the table shown in Fig. 6. The main organization cultures may be imagined as the hours on a clock; a real organization can be situated at any point on the circle, including the spaces between the "hours" (the main points).

MAIN CULTURES

FUNCTION STUDIED	POWER	ROLE	TASK	PERSON
Best fit for	Crises	Routines	Creating new	Seeking lines
Management method:	Autocracy	Specialists	MBO	Laissez faire
Basic value	Power	Titles	Money	Satisfaction
Promotion base:	Protéges	Career	Results	Random
Decision-making.	Individual	Small groups Voting	Consensus	Mass

Fig 6. SOME CHARACTERISTICS OF MAIN ORGANIZATION CULTURES

None of the cultures is "good" or "bad", as their suitability differs with different situations.

We can imagine that the clock works continuously. Thus, each organization culture is constantly changing. It starts from the Power culture, proceeds gradually into Role culture, then changes into Task culture. Finally before turning back to the Power culture, it goes through the Person culture. To return to the beginning normally takes years, even decades, depending on the size of the organization and on its management's actions. Sometimes the management can "turn back the hands" or stop them. The longer they are stopped, the harder the pressure for movement.

This can be illustrated by an example. Normally an organization starts small and one man can direct it. But as time goes on the organization tends to grow and one man can no longer handle all the management alone. He must delegate some responsibilities to others. As a result a Role culture gradually emerges.

If this man does not delegate some of his power to someone else, then some activities of the organization are neglected. This directly affects the output of the organization and becomes a threat to it. In this sort of situation, somebody in the organization tends to feel responsibility and takes over power in certain areas. This is comparable to delegation of power, although power is actually seized, not delegated. This is a step toward Role culture.

6. RELATIONSHIPS BETWEEN THE ELEMENTS OF MANAGEMENT SYSTEMS

The overall efficiency of management systems depends on compatibility of all three elements discussed in section 2 and illustrated in Fig. 1.

In practice leadership principles are the first needed in an organization. The stage of development is determined as a reaction to situations originating in the environment. Function and structure describe how adaptation to environmental and inner forces is achieved. This also has an effect on leadership principles and especially on management techniques because the latter suggest various ways to cope with pressures inside the organization.

Leadership principles can be changed as a result of techniques that operate well, although this is not common. Normally there are situations where leadership principles give guidelines for selecting mushrooming management techniques that are suitable for the organization.

The stage of development also has implications on the direction of leadership principles and functions and structure. Principles differ according to time in the same organizations and especially when market situations change. Decisions made during expansion of markets are of a different type from those made when markets are apparently falling steadily. This also affects the management techniques. It is also a common prejudice that managers differ in their efficiency in running organizations at different times. One manager may be stronger in developing the organization, another in running it during stable times, another is best when massive changes must be made. Each of them differs from the others, perhaps not so much in his leadership principles, but at least a great deal in his management techniques. Functions and structures in organization also depend on the stage of development because they should reflect it.

These three elements give impetus to one another by activating and controlling. The better this is done, the better the results in management activities will be.

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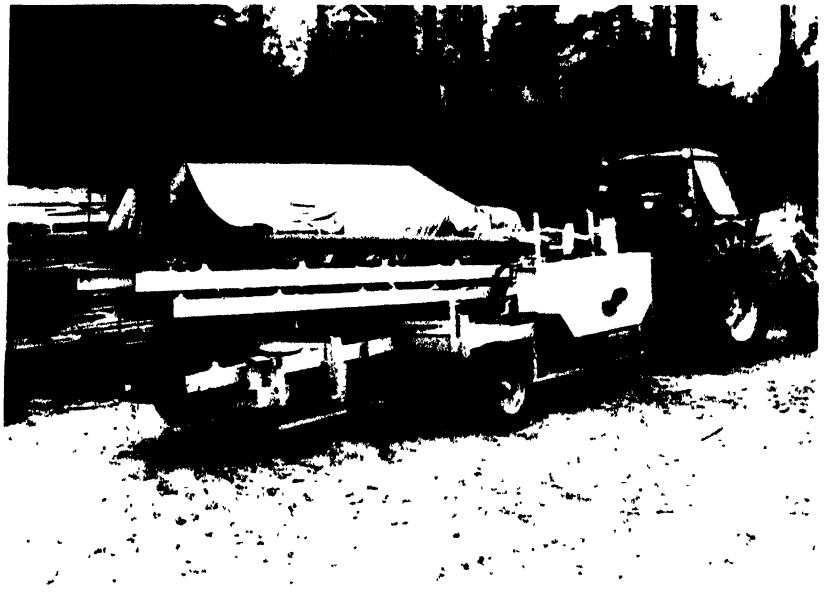

Mobile folded sawmill ready to move (Photo: H. Seppanen)

Mobile sawmilling at the Palvaanjarvi training centre
(Photo: H. Seppanen)

INVESTMENT PLANNING

by

Antti Vaajoensuu, Kari Rinne and Jyrki Setälä
Jaakko Pöyry Oy

1. THE PHILOSOPHY OF INVESTMENT PLANNING

1.1 General

Investment planning and control form part of the long-term development planning of any enterprise, so they must follow the general principles and aims of such planning discussed in the previous lectures. To avoid repetition, these principles will be only briefly reviewed in this paper.

1.2 Goals of investment planning

Establish a strategic investment policy for development in your company/factory/department framework.

Investment planning is a complex process which includes different tasks and phases. There are always different types of investment needs and different investment alternatives. The basic task is therefore to define a policy which will best fulfill the set development goals of the company. It has to be decided whether to invest in new projects and expansion or in improving existing operations. To improve the performance of the present mills, investments are often needed in renovation of the existing machinery and facilities; in research and product development; in marketing distribution systems and promotion; in management and organization development; in personnel training; etc. The kind of investment policy which would be the most beneficial in each case depends on the investor's strategic situation, available resources and general pre-conditions.

Create and develop new products/production methods and techniques within the framework of the plan of strategy.

When the general investment policy has been outlined, concrete investment plans can be prepared in accordance with the development aims set. These plans would select the most beneficial investment alternatives and specify individual projects and investments. Plans must be balanced and coordinated with the general development goals and the available resources such as raw materials, electricity, manpower and capital. In other words, the investments selected should make the best use of the resources available and existing investment opportunities. This general aim is easy to express, but the preparation of ideal investment programmes is a very complicated and demanding task in which many factors have to be taken into account.

No operating conditions are stable although climatic considerations do not change as often as political ones.

This fact is made even more difficult to cover by the long lifetime of all the major investments, the span of the investment planning often being tens of years, especially in forestry and forest industries. This involves uncertainty about future developments and trends, which always have to be taken into account in the planning. For these reasons, investment planning has to be supported by comprehensive studies in order to be realistic and allow sensible decisions to be made.

1.2 Investment studies

Establish a routine in your company/organization in which all investment proposals are investigated, technically and financially.

The purpose of investment studies is to define the different investment alternatives, compare them, and establish their techno-economic viability. It is important to the financer to know what return could be expected on the investment in question. Therefore, it is necessary for the private-enterprise or public-sector investor to be able to measure the benefits of different alternatives and assess their profitability. This involves various investigations and consideration of various aspects which are not comparable with each other. The purpose of an investment study is in fact to make the different alternatives as comparable as possible, and express their various benefits in a common unit - i.e. in terms of money. Nonetheless some effects and benefits such as generation of employment and other social benefits must be assessed separately.

Choose the right depth for each study depending on the phase of the project, not forgetting any sectors.

There are several phases in investment studies:

(a) identification of the investment idea and definition of the various investment alternatives;

(b) evaluation and techno-economic comparison of concrete investment projects including calculation of profitability and benefit to the national economy;

(c) preparation of project implementation plans and financing plans;

(d) final investment decision and finalization of implementation plan;

(e) control of investment during implementation and thereafter.

2. COURSE OF INVESTMENT STUDIES

2.1 General

The ultimate object of each investment study is to determine whether an investment idea or a conceptual plan can be developed into an economically viable and bankable project. Fig. 1 illustrates the basic approach of an investigation sequence frequently applied for this purpose.

This approach involves three phases of study:

1. Preliminary industrial survey
2. Prefeasibility study
3. Full feasibility study

The preliminary industrial survey identifies the potential investment alternatives. It therefore covers a broad range of project alternatives but is based on rough estimates. Its aim is to eliminate weaker alternatives as early as possible.

In the next phases - the prefeasibility study and feasibility study - the number of alternatives is successively decreased and the refinement of the study increased.

Each phase is followed by a decision whether to continue promotion of the project.

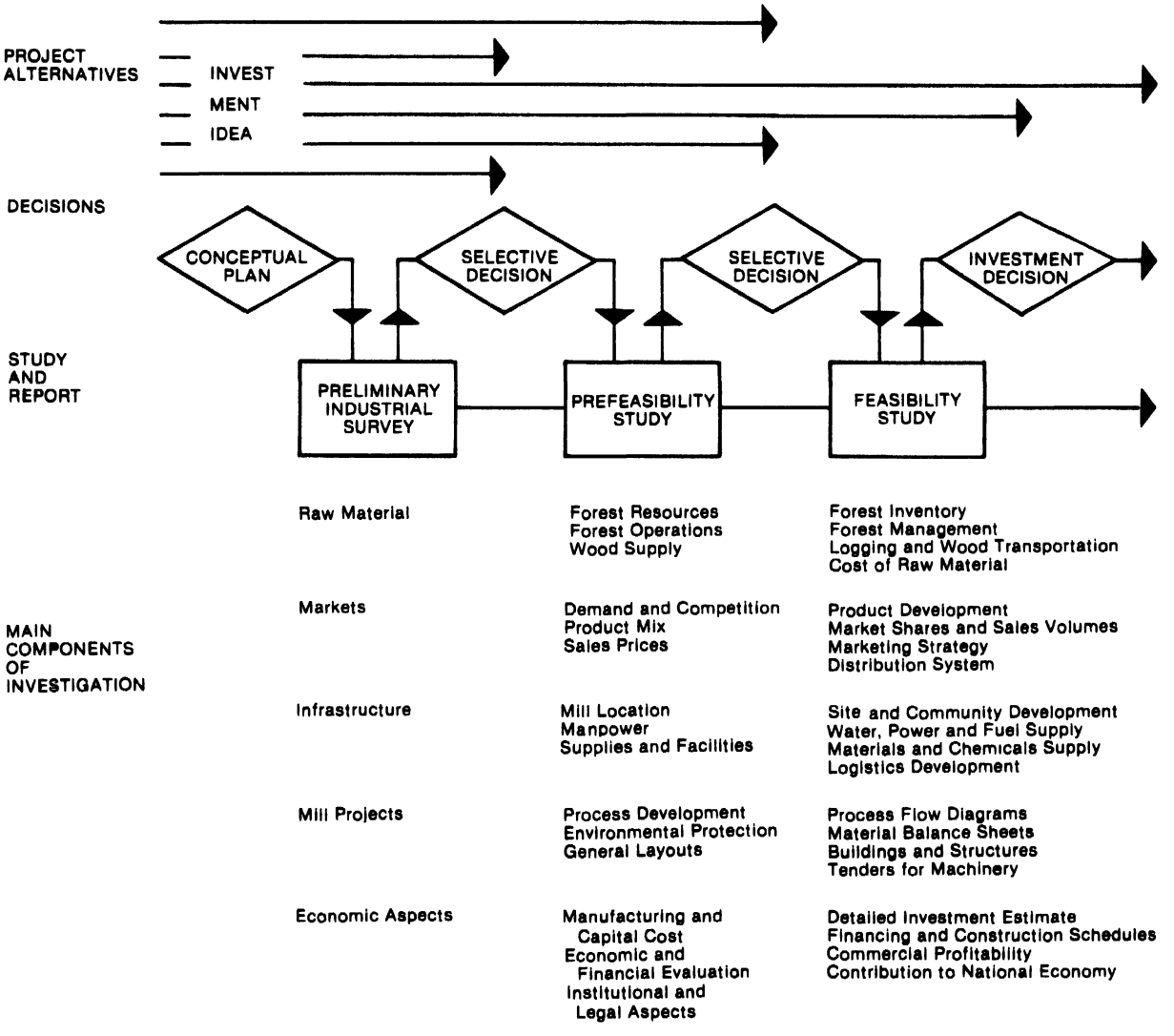

Fig. 1 COURSE OF INVESTMENT STUDIES

This stepwise procedure is used to minimize the time and cost involved and to limit the financial commitment in case the project is found unviable at some stage during the study. If the project survives the investigation sequence, it is likely to be the best alternative for investment.

The scope of these various studies will now be briefly reviewed.

2.2 Preliminary industrial survey

The purpose of this survey is to indicate the potential for industrial operations and to make recommendations for further studies.

It identifies the general investment objectives and available resources and includes various limitations. The essential issues are evaluations of raw material resources and market opportunities.

2.2.1 Raw material resources

The availability of suitable wood raw material is assessed on the basis of existing information on forest resources and wood utilization. The general locations of the resources are identified, the potential wood supply areas indicated and logging and transport costs roughly estimated.

A preliminary survey of the quantity and quality of existing wood resources indicates the type and size of forest industry which they could probably supply on a sustained basis. The approximate cost of the wood at the mill site can then be calculated and the additional information needed for the more detailed feasibility studies defined. This may include forest inventories.

2.2.2 Market survey

Realistic marketing opportunities are assessed on the basis of a preliminary market survey. The survey aims at establishing the supply and demand for selected products and providing information on quantities, grades and prices. The sizes of potential markets are estimated from tentative market projections and their effect on the viability of the project or projects, particularly if the markets are suspected to be too small and export prospects are nonexistent.

2.2.3 Infrastructure

The purpose of this part of the preliminary survey is to indicate and evaluate a few possible mill locations in relation to wood sources, markets, transport connections and general infrastructure. The availability of electricity and water, and the facilities for disposal of effluents are of prime importance, especially for pulp and paper industries.

2.2.4 Preliminary designs

Designs for possible mill alternatives are outlined on the basis of the raw material resources, markets and product specifications. Designs are based on current industry practice and hypothetical mill models in order to estimate capital and operating costs roughly.

2.3 Prefeasibility study

The prefeasibility study aims at more detailed specification and evaluation of the projects identified in the earlier studies. Sometimes an identification study can be included as an initial phase in the prefeasibility study.

Evaluation of the alternatives is based on a fairly comprehensive raw material inventory, a detailed market projection, and specific production programmes and technical designs, as indicated in Fig. 2.

2.3.1 Wood raw material

As mentioned earlier, reasonably complete information on available wood volumes grouped by species, grades, sizes and potential end uses is needed for a prefeasibility study. This information provides a basis for determining possible alternatives for sustained industrial utilization of the raw material and possible locations for the contemplated industrial units.

The wood raw material survey outlines tentative cutting plans consistent with the long-term wood supply. Proposed harvesting and log transportation systems are described, including an indication of the equipment and methods to be used. These preliminary plans provide a

basis for estimating the personnel, machinery and other facilities necessary for the wood supply; thus the wood cost at mill can be estimated.

2.3.2 Market survey

Generally, the range of possible products will by now have been limited by the findings of earlier studies. It is therefore possible to concentrate the market survey on certain clearly defined products.

The market survey gives a complete breakdown of the prospective markets for the projected mills, covering domestic markets and selected export markets if justified. A tentative sales plan is outlined specifying total sales to each area, sales prices, market shares, competitive position, etc. The study also presents guidelines for distribution systems, the marketing organization and necessary marketing activities, promotion, and so on. Mill net sales prices for the different products are estimated and the estimates used in calculating future revenue and evaluating the economics of the projects. Assessing the competitiveness of each project is one of the most critical tasks of the survey.

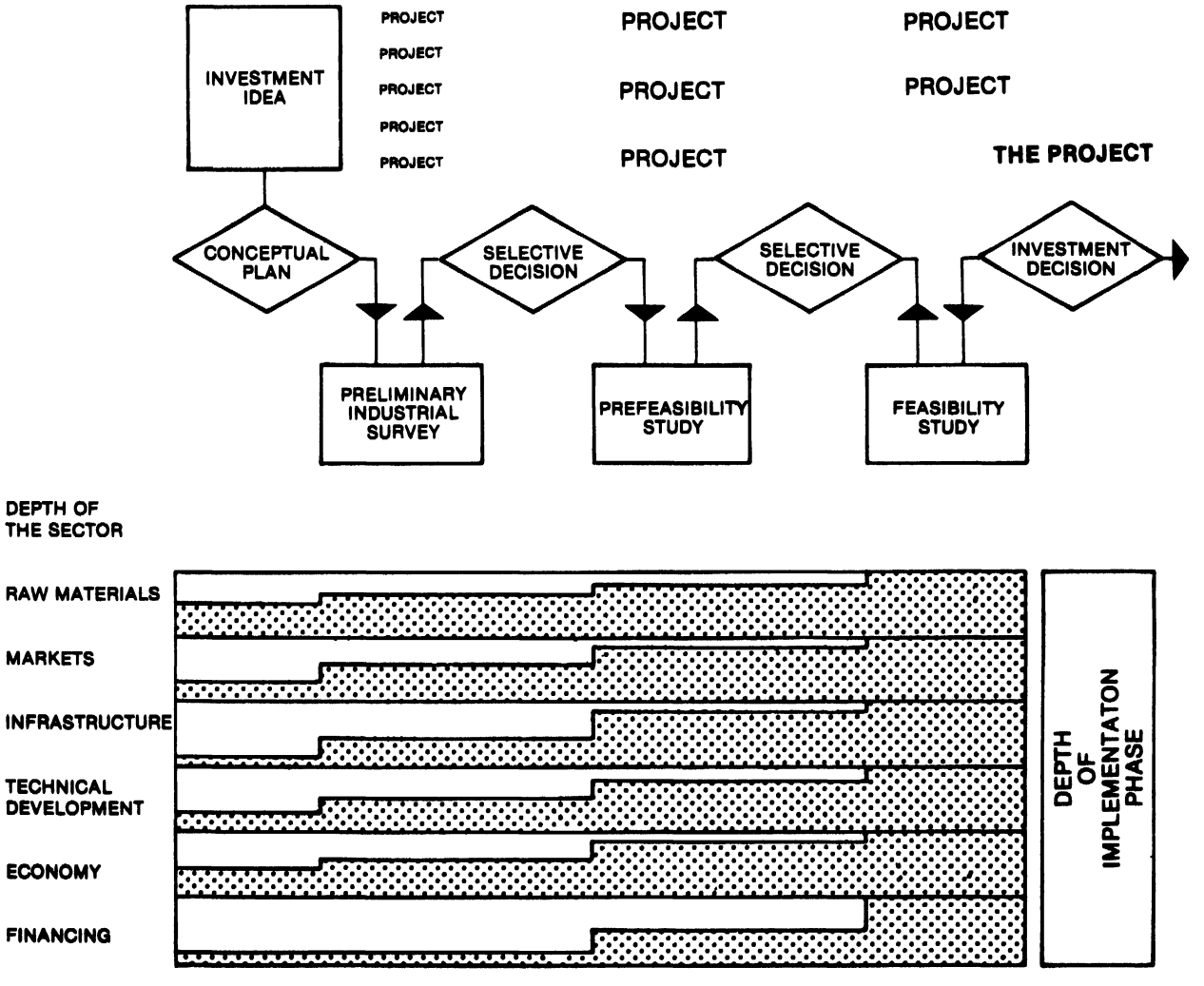

Fig. 2 COURSE OF INVESTMENT STUDIES

2.3.3 Mill location study

The purpose of this study is to provide a basis for a techno-economic comparison of the possible sites. The number of sites considered is small. All the relevant factors are subjected to a closer examination than in the preliminary industrial survey.

Preliminary plans for the site and community development, for water, power and fuel supply, and for material and chemical supply are outlined in order to estimate all the site-related costs, including the costs of transporting raw materials, various supplies and finished products. It is also necessary to suggest how investments in infrastructure such as roads, ports, communications, housing and other forms of community development should be divided between the proposed project and possible public financing.

2.3.4 Mill design

Appropriate mill designs, consistent with the wood available, marketing and other factors assessed in the other parts of the study, are worked out for the selected mill. Preliminary designs are prepared in sufficient detail to estimate capital cost. The design work covers and takes into account the following main criteria:

- raw material supply and specification
- annual production and product range
- product mix and design capacities
- recovery rates
- operating time and efficiency estimates
- preliminary design of the manufacturing processes and mill layouts
- preliminary plans for power and water supply, various utilities and civil works
- personnel requirements, divided between skilled, semi-skilled and unskilled workers, and technical and managerial personnel
- tentative scheduling of implementation time
- environmental protection and impact study.

2.3.5 Economic calculations

The economic calculations provide a basis for establishing the relative priorities of the mill project alternatives that have been identified, and indicate their approximate profitabilities.

The investments required for the projects are estimated from the technical descriptions and specifications. Usually investment estimates are based either on file cost data adjusted to local conditions and updated to the current price level or on tentative budget proposals from machine suppliers. No detailed cost estimates are given.

Manufacturing costs are estimated from the specified consumption figures and specific cost data collected for each project. The manufacturing costs are divided into variable and fixed components by type and item.

Profitability is usually estimated by the discounted cash flow method, as described in the following section.

Cash flow tables are prepared incorporating data on sales revenues, manufacturing costs and investment requirements. Sales revenues are calculated on the basis of the marketing plan and sales prices arrived at in the market survey. Annual manufacturing costs are calculated from the projected growth in the production level. The timing of capital cost expenditure is estimated from the preliminary construction time schedule.

The economic risks involved in the projects are indicated through sensitivity analyses, which assess the dependence of project profitability on changes in key variables such sales revenues, wood costs and capital costs.

The value of the projects to the national economy are determined in a separate economic analysis, as described later in this paper.

Finally, socioeconomic, institutional and legal aspects are considered, and the main risks of the projects discussed.

2.3.6 Recommendation

A prefeasibility study recommends which of the selected project alternatives is the most promising and whether it is considered attractive enough for implementation and analysis in a feasibility study.

2.4 Feasibility study

If the identification and prefeasibility studies indicate that a project is attractive and seems feasible, a full feasibility study should be made on it.

This presents all the information required for taking final investment decisions. Consequently, the study should convince potential investors that the project is technically, economically and financially viable, and that the investment climate of the country is satisfactory for any foreign participants.

As possible alternatives will have been compared in earlier studies, only the best alternative or alternatives are included in the feasibility study. The work is performed with specific investors in mind, and thus should consider their concepts of the projects.

The structure of a feasibility study is similar to that of the prefeasibility study, the difference being its depth and the presentation, as indicated in Fig. 1. For instance the wood raw material part of the study is based on reliable inventory data and positively identified wood supply areas and production alternatives. The survey defines the raw material sources, management and harvesting plans in sufficient detail for a complete design of woodlands operations and estimation of the related costs.

The market study concentrates on the product mix determined in the earlier studies and checks the existence of outlets for the new production. Detailed sales and marketing plans are also outlined.

At this stage the mill site study concentrates on the selected site or sites. The study is intended to define the site and community development, mill site layout and related technical plans. A lot of planning and engineering is needed to provide adequate information for accurate economic analysis.

Fairly comprehensive preliminary engineering is carried out to define the recommended alternatives and find the best ones. It includes firm designs for the mills and all necessary auxiliary departments to provide a basis for invitations to tender for the main process machinery and for complete detailed engineering in the implementation phase. The designs allow investment requirements and manufacturing costs to be accurately estimated.

Relatively complete implementation plans with detailed time schedules are also included.

The objectives of the economic calculations are identical to those of the prefeasibility study, but these calculations are more accurate and detailed.

The total investment requirements of the project at a given cost level are estimated from the vendor's preliminary quotations invited for main machinery and other checked and updated cost data from similar projects.

The manufacturing cost estimates are checked against detailed process calculations, and sales revenues are predicted on the basis of detailed sales plans and price calculations.

A complete financial and economic analysis is carried out as described in the respective sections of this paper. They include financing budgets and related analysis.

2.5 Investment decision

Once the feasibility study has been made, financing can be negotiated and a final investment decision taken. If the project proves feasible and its financing has been arranged, implementation can start. This involves new phases in the investment planning process.

3. PHASES OF INVESTMENT STUDY

Whether you are planning work for others or for yourself the phases are: project definition, decision to go ahead, execution, evaluation and the phase where conclusions are drawn and results analysed.

A project can also include subtasks such as giving assignments to consultants and individual specialists. These special tasks would follow the above procedure. Fig. 3 shows the logic of the different phases.

Project definition and the targets of the planning work may be set down in writing as it is usually teamwork, and the opinions of the different parties involved are valuable.

Some aspects of project definition:

- define the final targets of the whole project and the targets of the specific task in question in this project
- collect previous material such as studies and other basic information
- define the required accuracy and depth of each sector, in line with the goals of the project
- a previously prepared standard list of study objects may be useful, but must be critically and separately reviewed in each case
- be sure that each party has fully understood the wording of the terms of reference.

The definition phase is followed by an organizational phase in which, for example, time schedules are prepared and resources allocated. Each sector of the study should have a responsible manager. The time schedule for a work study is best drawn up by calculating backward from the deadline of the whole assignment. Do not squeeze any subtask unnecessarily and so violate the standard of the study. Lack of time and hurry are often man-made. If it appears that any subtask will take too long to execute, reconsider the project definition and the demands of accuracy and start again.

The project starts with a simple order to go ahead, which is usually made at a general meeting. The items of the meeting are as follows:

- the goals of the project
- terms of reference
- organization, all parties and individuals
- time allocations and time schedule
- summary of previous studies and other available material
- presentation of project routines and standards
- decision on next general meeting.

Most important is the selection of decision criteria: technical, economic, environmental, etc. They may be both qualitative and quantitative. Quantitative criteria usually consist of a simple listing of the pros and cons of the project. The qualitative indicators support the quantitative ones, but not necessarily vice versa.

Comparison with other similar projects and plans is useful as it brings information about the operating conditions elsewhere and may help in making a decision. It may be noted that when important decisions are taken there is almost always too little information available and often what there is is wrong, but firm decisions must be taken in good time on the best information available.

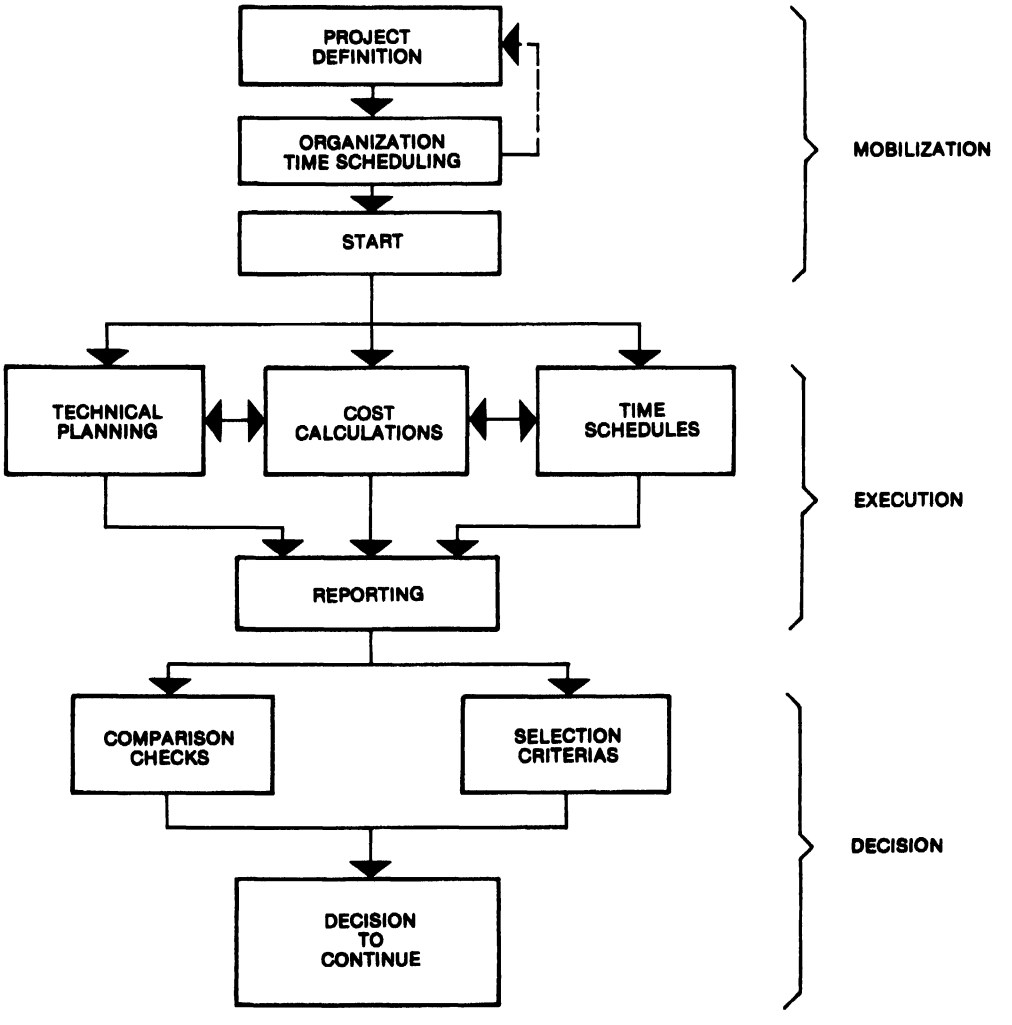

Fig. 3 INVESTMENT STUDY

Log conveyor with end-trimming of logs
(Photo: H. Seppanen)

Paper storage (Photo: H. Seppanen)

APPROPRIATE TECHNOLOGY FOR FOREST INDUSTRIES

by

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1. INTRODUCTION

In the first efforts to industrialize developing countries the technology introduced was an exact replica of that which at the time was used in the industrialized countries. It thus reflected the social, educational, institutional and economic conditions of developed countries. The result was, in many cases, disappointment, frustration and losses incurred by the investors.

Realization that conditions were different in the two groups of countries led to the conception of the blanket generalization that technology for developing countries should be based on small production units. The phrase 'small is beautiful' soon became an obsession and in the forest industries sector led in some cases to the establishment of mills which were just as unviable as the larger ones introduced earlier. The only difference was that the investment in each project was smaller. On the other hand, the number of projects was sometimes larger so the overall economic impact of failure could be just as great as in the case of larger-scale mills.

In more recent years, a more balanced approach has been taken. It has been admitted that the technology and scale of operation must be adapted to the requirements of each case and the local conditions; that is, the technology, including the scale of operation, must be appropriate. In many cases this still may mean simple technology to be used in small-scale mills, and the emphasis is therefore still on 'small', although the meaning of the word is now considered to be far wider. For instance, the FAO Portfolio on Small-Scale Forest Industries, although the title refers to small mills, in fact encompasses a variety of options, from very small, simple operations to comparatively large enterprises.

In spite of the fact that there is general agreement on the need for technology to be 'appropriate', there is very often a confusion as to what is appropriate. In the following, some questions relating to this will be highlighted.

2. LARGE OR SMALL?

The main fault in past overemphasis on minor small-scale plants was that it was assumed that conditions were the same in all developing countries, to the extent that it was suggested that standard mills be developed by the UN system for installation in developing countries. Although some of these efforts to standardize provided design concepts which were useful as indicative solutions to be applied in some cases, they did not lead to any successful manufacture of that type of equipment nor any installation based on these concepts.

It has been stated that forest industries in the industrialized world started on a small scale and consequently the developing countries should start in the same way. On the other hand, the mills in the industrialized world 50 to 100 years ago did not have to compete with

large-scale, extremely cost-efficient companies with a world-wide marketing network. This is especially serious if the mill is expected to export its production, but it can also have disastrous consequences if the mill has to compete with large mills on the domestic market.

India is often cited as an example of the successful introduction of mini-scale manufacture of paper at production rates of 10 to 30 tons a day, using waste paper or agricultural residues as raw material. There is no doubt that waste-paper-based manufacture of paper on a very small scale can be financially viable in developing countries, especially if second-hand equipment is used. It is, in fact, a commendable first step in the development of a paper industry. Use of agricultural residues, whenever available in sufficient quantities, within an acceptable transport distance, can also be recommended on a small to medium scale.

The fact that the mini paper mills in India are financially viable is due to several reasons, many of them specific to India. The success of these mills depends in the first instance on Government policy. Since there is a shortage of paper in the country, the Government has introduced incentives for private investors to produce paper locally from available raw materials. Through the granting of substantial subsidies and provision of incentives, interest in the establishment of such mills has been created among local entrepreneurs. The investment requirement is within the range of funds which can be raised by the local private sector.

Because of this Government policy, there is now a situation in India where roughly 25 percent of the paper produced in the country is manufactured by 75 percent of the mills, the remaining mills having capacities of between 100 and 300 tons a day. This development has been possible for several other reasons:

(a) Availability of skills in design and construction of pulp and paper mills;

(b) Availability of skills in equipment design and manufacture;

(c) An abundance of engineers with skills in pulping and papermaking as well as skilled and semi-skilled labour to operate the mills, available at low cost in a low-cost environment.

First of all, availability of skill within the country means that no, or very few, expatriates are required to establish pulp and paper mills. Secondly, since there is an abundance of people at all levels with knowledge of pulping and papermaking, installation of a number of small mills instead of a few large ones, which would satisfy the very large pulp and paper market in India, provides job opportunities for these people. In most other developing countries, there is a shortage of suitable personnel and for that reason alone the installation of a number of mini paper mills would not suit their conditions, since these countries would have difficulty in manning even one mill.

From the above, it can be concluded that there is no standard small mill which can be recommended for use in all developing countries, nor is it possible to exclude large-scale production since conditions may be found which are favourable for this as well. The size of the mills has to be adapted to each specific set of conditions in a country or subregion. In general, however, it can be stated that in most developing countries the mills serving only domestic or subregional markets would have to be of small to medium size. The definition of small or medium in this case depends entirely on factors such as the raw material used and the product manufactured.

3. NEW OR OLD TECHNOLOGY?

It has sometimes been recommended that developing countries install mills with the kind of technology which was used in industrial countries 50 years ago. The main reason for this is that the technology of those days was comparatively labour-intensive. Since there is a lack of sufficient employment opportunities in developing countries, this type of technology would seem to be well suited to their conditions. Again, this solution might be applicable in some specific circumstances but two questions arise from such a concept:

(a) Who can design such a mill today?
(b) Who can deliver the equipment needed?

For this reason it has been recommended that efforts be made to provide designs of this type of mill and that equipment manufacturers be stimulated to produce the type of equipment needed. Some manufacturers have shown interest in this to the extent that designs have been made specifically for developing countries in accordance with the guidelines given in various discussions. Nevertheless, they have found in general that their designs have not been accepted by the clients in developing countries who have placed their orders with manufacturers of more conventionally conceived equipment.

Second-hand equipment may seem to offer a solution to the problem of availability of old technology, but in many cases even second-hand equipment has gone through several stages of modernization.

4. TECHNOLOGY AND QUALITY

In the discussion for or against new or old technology it is often forgotten that the requirements of the market for the product have to be taken into account as well. For instance, a village sawmill can be of very simple design, producing sawn goods for use locally and in surrounding villages. If the sawmill caters for a well developed domestic secondary woodworking industry, the requirements in uniformity of quality and dimensions are considerably higher. If the production is for export to industrialized countries, they are higher still.

It therefore follows that simple, old technology cannot always be recommended. The more advanced the market, the more advanced the technology needed to meet its requirements. However, it is not only the quality requirements of the market which make demands on technology. Equally important in this respect is the requirement for economic feasibility and thus competitiveness on the market. A mill exporting its products must accordingly be just as cost-efficient as its competitors and this may call for very sophisticated technology. It therefore needs to be well understood that, unless corresponding technical knowhow already exists in the country, the cost of transfer of sophisticated technology must be taken into account at the planning stage of such a mill.

5. LABOUR INTENSIVENESS

In general it is emphasized, in the context of appropriate industries, that labour in developing countries, as opposed to the conditions in developed ones, is cheap and that there is a need for industries which offer large employment opportunities. In fact, this has led to the development of a methodology for estimating the economic returns - as opposed to the financial returns - of a project using primarily the employment and increased earnings of the local population as a criterion. The result has been over-emphasis on this aspect of the establishment of industries.

It is true that the wages paid to a worker in developing countries are in general much lower than those paid in industrialized ones. It is also true that it is important that the establishment of industries in developing countries leads to employment opportunities. What is forgotten is that usually the output per worker in developing countries is also much lower for various reasons. (Malnutrition is one of them, but not the only one.)

Thus, the number of workers employed for a specific job can be as high as ten times the requirement in an industrialized country, mainly where unskilled and semi-skilled labour are concerned. This factor reduces some of the labour-cost advantage of developing countries. The addition of the costs of social benefits to this reduces the advantage even further.

The importance of employment opportunities is sometimes also misunderstood by well-meaning engineering companies from industrialized countries who proudly show that the mill design is such that the plant will employ a large number of people. However, 80 percent of this large number may consist of semi-skilled and skilled labour, of which there is a shortage in most developing countries. On the other hand, there is no doubt that the higher the level of sophistication of technology, the higher is the requirement of skills among the labour force needed to operate the mill. The conclusion from this seems to be that when sophisticated technology is required and introduced, the employment aspect should not be overemphasized and a serious effort should be made to provide adequate training for the semi-skilled and skilled labour force.

6. CRITERIA OF APPROPRIATENESS

In the light of the preceding sections, it is obvious that appropriate technology can mean different things under different circumstances and conditions. Appropriateness, therefore, has to be evaluated against some sort of a checklist. Thus in each case an evaluation has to be made of the following:

(a) Raw material resources - quantity and quality
(b) Market-size and special requirements
(c) Product - quality appropriate for the market
(d) Technical capability - production and use
(e) Managerial capability
(f) Financing - national capacity to raise, service and handle
(g) Employment - direct and indirect
(h) Environment
(i) Political and policy considerations.

The above list of criteria may not be complete and the criteria may not carry the same weight under all circumstances. In many cases, the alternative chosen might be dictated by special emphasis on one or two criteria which may have implications on the weight of the others. One criterion not mentioned above is financial viability of the project. This is perhaps one of the most important ones, but basically follows from the evaluation of the various aspects given in the checklist above. Even if the project were not financially viable in the initial years because of the additional costs of transfer of technology, the aim should always be that, within a reasonable period during which some subsidy or protection might be granted, it should become so.

PROJECT IMPLEMENTATION AND EVALUATION

by

Seppo M. Saukkonen
Ekono Oy

Part 1. PROJECT IMPLEMENTATION

1. INTRODUCTION

1.1 The project

An investment project is always a unique method of performing a task, and its limits must be explicitly defined in terms of (i) cost, (ii) timing and (iii) scope. One of these components cannot be changed without affecting another. If for example the project scope were to enlarge, at least the economy (project cost) would be changed; and if the implementation time turns out to be shorter than planned, either the scope must be reduced or the cost increased.

If a project has been started, it cannot be stopped incomplete without large economic losses; and therefore performance must not fail. The organization for a project is also unique; when the project is finished, the project group disbands.

The final results depend largely on project organization. The leader must be a person who has the ability to control the project as a whole and who is also capable of taking total responsibility for the task. The project group must include the best available specialists, who together take the responsibility for carrying out the project.

Specified responsibility is typical and important for project work. It is important to know the limits of responsibilities in all work, but especially when working in a project group. This delegation of responsibilities gives an opportunity to specify individual targets, to check on progress toward them, and clarify the tasks for each person in the group.

The time factor is important, and is often a reason for forming a project group. The project organization makes it possible to perform the work during time limits which have been planned in advance.

1.2 Project work

Every person who is responsible for industrial development and results is involved in project work. This fact is attested to by this company's experience with project activity of the group method and its suitability for developmental work, especially investment analysis and projection.

Experience has shown that well controlled and systematic project work is almost the only way to reach acceptable results with medium-scale and large-scale investments; and in most cases it is a precondition to getting the venture financed from external sources.

Many manuals and sets of instructions about project implementation and evaluation are available (see Appendix 2) and the World Bank (WB), commercial banks and other financial institutions, as well as consulting companies, have their own methods of handling projects (see Appendix 1 for principal abbreviations and acronyms used by financial institutions). The guides published by these agencies are valuable. In addition, persons

responsible for projects normally have considerable experience and have developed their own methods.

1.3 Main issues to be discussed

This lecture comprises: (i) general presentation of project phases and work focused on developing countries and the mechanical wood processing sector, (ii) description of activities and conditions connected with project implementation and (iii) methods of evaluating projects. The importance of individual initiative and activity in order to increase productivity and reach economic and other targets will be discussed in the case studies section of this workshop.

Mistakes may occur in all work; but by having a control system that has been tested over time it is possible to avoid at least some of them.

2. PROJECT PHASES

2.1 Project cycle

The different phases of an investment project can be specified and grouped in different ways depending on the reason for phasing the work. A project owner has his special purposes as do any developing agencies, financial institutions and consulting companies, and therefore the phases need not be similar.

The phases which cover the whole work form a project schedule or cycle. Three typical examples, suitable for medium-sized and large projects are illustrated in Fig. 1. The phases used for this study are: (i) identification, (ii) preliminary investigation, (iii) prefeasibility study, (iv) feasibility study, (v) financing phase, (vi) implementation phase, (vii) startup phase and (viii) operation phase.

External agencies and financial institutions often benefit from the highly developed World Bank system. As illustrated in the figure, the bank includes in the preparation phase all the activities needed to prepare the project for appraisal evaluation. FINNIDA's system is more or less similar. These issues are discussed in more detail in the following sections.

2.2 Project identification phase

Developmental work is part of the normal activity of governments and corporations, and it is one of the primary responsibilities of persons who have a leading position in organizations. Depending on the organization, this work is called business or corporate planning, or industrial or sector policy decision-making. In principle the work is similar in all organizations, but the solutions will be different e.g., in a country's wood mechanical sector at governmental level and for a private entrepreneur.

Development planning often means identifying projects. It should be remembered that project ideas are seldom born without private initiative and activity. These need to be developed, and this means systematic hard work.

In producing project ideas the following aspects must be considered: (i) the objective and main targets of development, (ii) the present situation in the sector or enterprise, (iii) the market situation and competitors, (iv) strengths and weaknesses and available knowhow, (v) raw material, personnel and other resources, and (vi) risks involved in the projects.

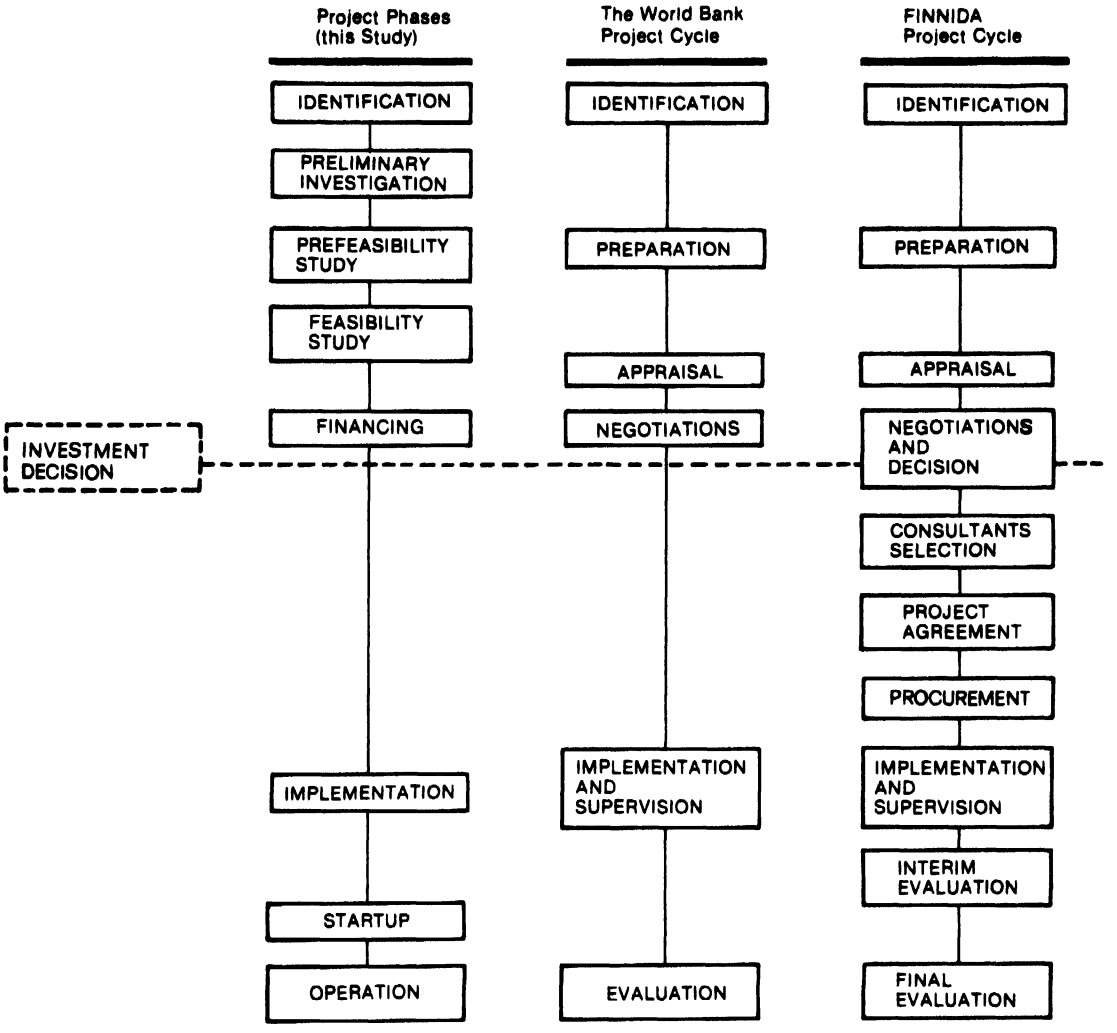


Fig. 1. THE PROJECT CYCLE USED IN THIS STUDY, AND THOSE OF THE WORLD BANK AND FINNIDA (See sections 3.2 and 3.3)

In many developing countries projects are identified by industrial development banks or industrial development departments established by governments which have resources to be utilized.

In addition to governments and private entrepreneurs, several financing agencies are active in project identification. The World Bank, for example, cooperates with governments in order to select suitable projects that support national and sectoral development strategies and are feasible according to the bank's standards. In addition to the World Bank and other institutions mentioned above, external assistance is given to developing countries by national development aid programmes such as FINNIDA.

External assistance is helpful and necessary; more important, however, is the initiative of individual national developers. Without this initiative a country's goals, sectoral objectives and the economic results of enterprises and entrepreneurs cannot be attained; and the projects which would most benefit the country cannot be identified.

2.3 Preliminary investigation phase

After projects have been identified comes the phase of preliminary investigation. This is the earliest one in a complete planning study. The intention at this point is to collect enough information to decide whether the project or projects should proceed or not. The investigations are made without any major expenditure but they must be comprehensive enough to give grounds for analysis.

The items to be investigated depend on several factors such as project size, the entrepreneur's earlier experience with the products to be manufactured, and his general knowhow. Certain items are covered from different viewpoints and at different levels of precision in many investigations. The following are typical for medium-sized investment projects in the mechanical wood products sector: (i) markets, quality requirements and end-product pricing, (ii) competitors and their future plans, (iii) availability and costs of raw material, (iv) estimates of investment and production cost, (v) project location and infrastructural aspects, (vi) preliminary financing plans, (vii) calculations of preliminary return and profitability, (viii) risks and benefits.

The local entrepreneur or company or government representative may collect information from available official statistics, from discussions with competitors, future customers and local bank representatives and contacts with other available specialists. It might also be possible to meet FAO or World Bank representatives to gather more information.

A foreign investor interested in studying investment opportunities in the country may send an executive to the area to assess the matter.

2.4 Prefeasibility study

The first formal stage of the entrepreneur's investigations is a prefeasibility study. This should concentrate on risks which could lead to insufficient profitability. It may therefore result in the discontinuation of further analysis and project studies. Considerable experience is needed in order to be able to identify viability. Long and costly investigations should be avoided if possible.

The scope of a prefeasibility study must be specified for each project, because the risk and profitability issues will vary from project to project. Sometimes markets need special investigation, sometimes pilot-plant tests are necessary to determine the suitability of the raw material for the product. Transportation is often a major issue.

The results of the prefeasibility study can be convincing enough to dispense with the need for further study to reach a decision on implementation. Generally, the next step, at least in large projects, is to carry out a full-scale feasibility study.

2.5 Feasibility study

A feasibility study is the final examination of the economic, technical and financial aspects of a project before implementatioon. In order to get reliable results, the findings, calculations and estimates of earlier studies must be checked and analysed in detail. The specialists who carry out the study must be experienced, and persons who know local conditions must be involved in its preparation.

The scope of the study depends on several factors such as project size and how much of the sector and the project issues has already been analysed. There should always be a well-considered balance among all parts of the study. All the essential issues affecting viability must be studied in detail.

2.5.1 Market studies

Markets and marketing are always an important issue, and should be one of the first things on which the feasibility study is based. The future market situation is especially important in determining the project's viability. Nobody knows exactly what the market situation will be in ten to fifteen years' time, but without a well considered estimate the project's chances of success cannot be judged.

The larger the project, the more important the need for a market forecast. It is also a fact that in aiming at large profits large risks must be accepted; but those risks can be reduced and controlled in carefully implemented projects. In this connection market issues are the most important.

Risks are largely connected with a project's profitability. The better the profitability figures, the larger the risks that can be accepted. If, for example, the financial rate of return (IRR) is about 30% instead of 15%, one could accept a considerable risk without expecting a too low project profitability.

2.5.2 Other issues in a feasibility study

In addition to markets, a feasibility study must be based on several other factors for which information is vital. These are (i) forest resources and forest operations, (ii) selection of the mill site, (iii) scope of the project, (iv) plan of implementation, (v) management and training, (vi) capital and manufacturing costs, (vii) financial analysis.

The final economic assessment needs well-prepared estimates of capital investment, sales revenues and manufacturing cost. These are to a large extent based on physical and technical measurements, and are converted into monetary terms by application of rate prices. Assessment is often made according to: (i) pro-forma statements of profit and loss and cash flow, (ii) analysis of the IRR, (iii) analysis of sensitivity and (iv) analysis of risk.

The issue of management is often undervalued in a study because it is difficult and needs much experience to evaluate. Effective management eliminates weaknesses, and through its own initiative it uses the available resources in the best way. On the other hand, ineffective and weak management increases bureaucracy and costs and lessens the possibility of good profitability.

Irrespective of who it is, the project owner's responsibility is to ensure that management and organization are active and effective in the project's preparation and implementation phases and finally in operation of the mill. The feasibility study must cover these issues in detail. However, it must be kept in mind that only the owner/entrepreneur has full responsibility for the project and its results. An outsider who executes the feasibility study has only a limited view of the project as an entity and - what is more important - limited responsibility for the economic results.

2.6 Financing phase

After the main findings of the feasibility study have been identified and the viability of the project proven, the owner/entrepreneur must prepare a reliable financing plan. If external financing is needed, discussions must be initiated with potential partners, financing institutions and guarantors.

The plan must show the major sources of finance divided into equity, loans and income from operations. Its structure depends largely on the entrepreneur's financial position, the size of the project, and the general economic situation. If the preparations have been done well, and the indications are that the risks will be low and the profitability high, it is normally easy to get financing. It is quite common for the potential external financier to check first on the issues involved in the management of the future operation.

Some examples of project financing in the mechanical wood sector are presented in Table 1.

Table 1

EXAMPLES OF PROJECT FINANCING

	Small			Medium-sized		Large	
Case:	a	b	c	a	b	a	b
Equity	-	-	-	30	50 %	30	50 %
Loans							
. long-term	80	40	0	40	20	60	40
. short-term	0	40	0	20	30	5	10
Income from operations	20	20	100	10	0	5	0
Total	100	100	100 %	100	100 %	100	100 %

2.7 Implementation phase

Once the owner has secured financing, implementation of the project can start. This phase may be divided into five parts as follows: (i) final clarification of financing and agreements with the investor(s), (ii) engineering, (iii) site preparation and construction, (iv) planning of operations, (v) commissioning of equipment.

Engineering involves the necessary design work, equipment specifications, flow diagrams and layouts, preparation of working drawings, tendering and tender evaluation. (See section 5 for more details.)

The work involved in this phase should be done by people with a great deal of experience, and it is often commissioned to a consulting engineering company, or carried out on a turnkey basis (see section 5.2).

The engineering in a large project depends largely on local conditions and the scope of the project. It is usually divided into (i) basic and (ii) detail engineering. An example of standard activities is listed in Table 2.

Table 2

AN EXAMPLE OF ACTIVITIES IN BASIC AND DETAIL ENGINEERING

Basic engineering	Detail engineering
Selection of procedures	**Mechanical engineering**
Administrative organization	Selection local partners
Project procedures	Flow sheet diagrams
Code accounts	Operating instructions
Mill standards	Department layouts
Selection guide for piping	Foundation layout drawings
Purchasing principles and tendering instructions	Engineering for piping, cable routes, etc.
Overall schedule	Machine & equipment contracts
Purchasing schedule	Machine list completion
Erection schedule	Fire protection
Civil construction schedule	Personnel facilities
Finalizing technology	**Civil engineering**
Reviewing the feasibility study	Infrastructure design
Mill concept finalizing	Structural engineering
Departments' flow sheets	Foundation drawings
General mill layout	Tender documents
Preliminary department layouts and process description	Selecting civil contractor
Earthwork and building description	Construction supervision
Pipings	**Instrumentation engineering**
Budget reconciliation	
Preliminary machine lists	Selection control systems
Environmental impact statement	Loop lists
	Equipment contract
Purchasing activities	Instrument lists
	Circuit diagrams
Enquiry specifications	
Reception of tenders	**Electric engineering**
Tender evaluation	
Letters of intent for purchasing orders	Power consumption clarification
Budget follow-up; cost control systems	Purchased & own power and steam generation clarification
Engineering information schedules	Temporary power facilities
Expediting	Motor and cable lists
Civil contractors	Lighting
Machine & equipment contractor	Equipment contract
Purchasing minor equipment	Circuit diagrams
Cost control	

After financing is guaranteed, site preparation and many aspects of construction can be initiated almost immediately, on the basis of early design criteria and specifications. Some portions of this work can continue even after start-up.

Long before construction work is completed, the entrepreneur must give consideration to many administrative matters related to normal operating. This includes the hiring of management staff responsible for operation, and the various levels of technical, operational and mill labour necessary to run the enterprise. Associated with these personnel activities are the compilation of the necessary instruction and operating manuals and in-plant training sessions to instruct new personnel in their duties. Operational and financial control systems must be established to permit management to control the day-to-day operations of the mill, and the required recording and control forms must be drawn up and printed. Sometimes assistance is needed in these activities. Several consulting firms are experienced in giving the services. (See section 6.)

The equipment and departmental units must be tested after installation. They can be done separately to the extent that the units are autonomous. Supervisors and operating crews must test them to ensure that they are fully operational and that any changes necessary are made prior to start-up.

2.8 Start-up and operating phases

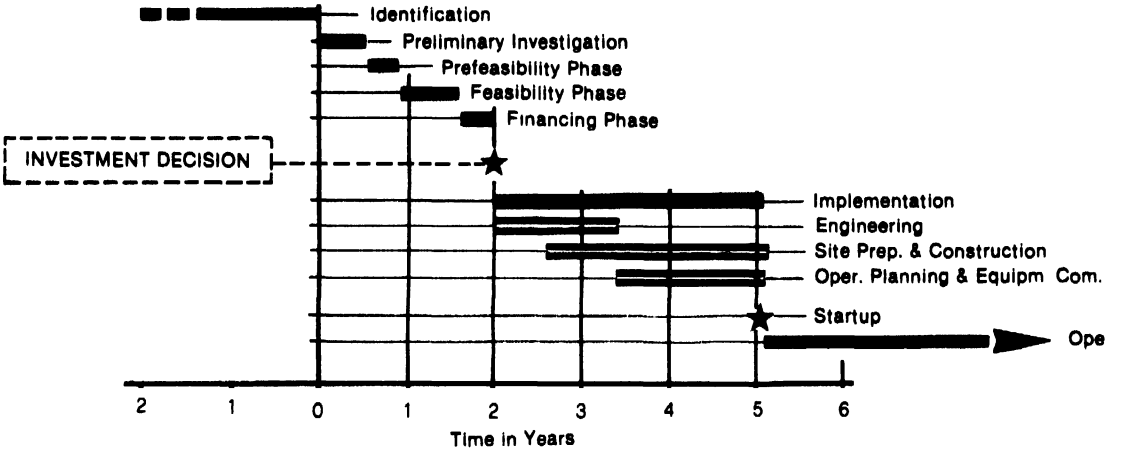
Start-up is the time at which the commissioning of individual components has been completed and the decision has been made to carry the material flow through the entire mill from the logyard to the end product. The efficiency of mill start-ups varies according to the thoroughness and efficiency with which the preliminary planning and commissioning have been executed. Technically speaking, the start-up is a point in time, but in fact the mill operators may have to spend a period in integrating the flow of materials from component to component.

After start-up, the mill/factory often needs an extended running-in period, during which the standards of product quality are attained and the intended production capacity is reached. The length of the running-in period can vary widely, depending on the competence of the designers, start-up personnel, and especially management.

2.9 Time requirements

The time required for the project schedule depends largely on organizational and decision-making aspects. Two typical examples of medium-sized investment projects in the mechanical wood products sector are illustrated in Fig. 2. Despite the fact that the project scope is the same in both cases, case B needs only half the time for implementation that does case A. The crucial difference is project management.

CASE A: SAWMILL INTEGRATED WITH PANEL MILL, SAWNWOOD AND PANELS 40,000 m^3/YEAR



CASE B: SAWMILL INTEGRATED WITH PANEL MILL, SAWNWOOD AND PANELS 40,000 m^3/YEAR

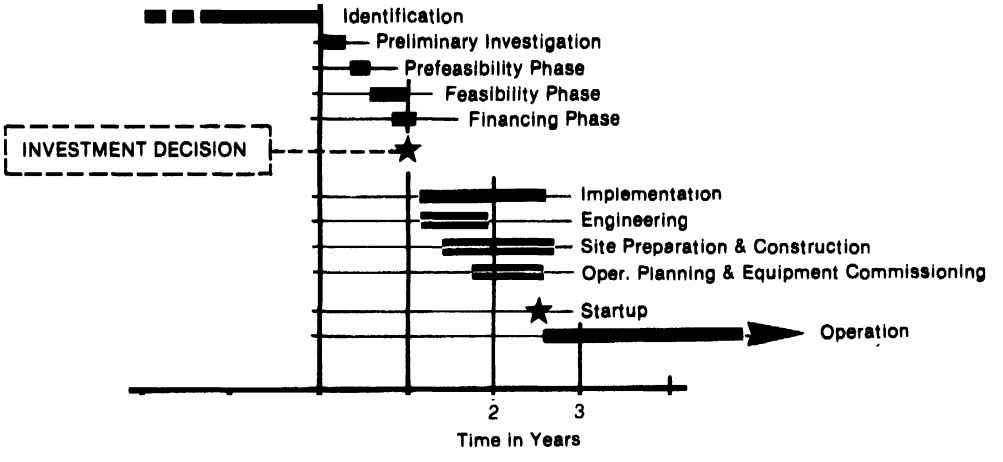


Fig. 2 EXAMPLES OF TIME REQUIREMENTS OF MEDIUM-SIZED INVESTMENT PROJECTS

3. PROJECT CONTROL BY EXTERNAL AGENCIES

3.1 Introduction

The external agencies whose main business is to assist and/or finance projects in the developing countries always give a lot of attention and resources to careful evaluation and appraisal of a project. In addition, several agencies are involved throughout the project from the beginning in order to ensure that the development work will benefit the country in the best way. In the following paragraphs project work of two agencies, the World Bank and FINNIDA, has been summarized.

3.2 The World Bank project cycle

The World Bank (IBRD and IDA) project cycle contains the following phases: identification, preparation, appraisal, negotiations, board presentation and approval, implementation and supervision, and evaluation (see Fig. 1). Each phase leads to the next and the last phases produce new approaches making the cycle self-renewing.

3.2.1 Identification

The first phase of the project cycle - identification - has a high priority. Country economic and sector analyses carried out by the bank and planning work made by possible borrowers provide an important framework and the basis for a continuing dialogue between the bank and the country on an appropriate development strategy. Through this dialogue and the analyses projects that meet objectives can be identified.

In practice, both the bank and the government are involved in making the process complex. Country economic analyses are made by the bank, but sector analyses are sometimes made by the country itself or through one of the bank's cooperative programmes or bilateral aid programmes. The work has to meet bank standards.

Once identified, projects are incorporated in each country's lending programme at the bank, which forms the basis for the bank's future work in the country. The bank's lending programmes are used for programming and budgeting its operations and for ensuring that the resources necessary to bring each project forward through the successive phases of its cycle are available.

3.2.2 Preparation

After a project has been accepted into the lending programme, an extensive period of close collaboration between the bank and the borrower begins. A brief is prepared for each project, describing its objectives in terms of technical, institutional, economic and financial conditions. The brief must also identify principal issues and establish the timetable for the project's further processing.

Experience has shown that the bank must have an active role in ensuring a timely flow of well-prepared projects. That role has a number of aspects: making sure that borrowers understand the bank's requirements and standards; helping borrowers to find the financing or technical assistance necessary for preparatory work and filling gaps in projects that have been incompletely or inadequately prepared.

Financial and technical assistance for project preparation - to carry out necessary feasibility studies or special studies - can be extended in a number of ways. The bank can (i) provide special loans, (ii) make advances from its project preparation facility - PPF, (iii) reimburse the borrower under the loan in question for preparatory work done earlier, or (iv) include funds for preparatory work in a loan for another project in the sector.

3.2.3 Appraisal

As the project takes shape and studies near completion, the project is scheduled for thoroughgoing evaluation or appraisal. This is solely the bank's responsibility. It is conducted by bank staff, sometimes supplemented by individual consultants, who usually spend several weeks in the field. Appraisal covers four major aspects of the project: technical, institutional, economic and financial.

Technical appraisal has to ensure that projects are (i) soundly designed, (ii) appropriately engineered, and (iii) that they reach the accepted educational, quality or other standards. This means that the appraisal mission must evaluate physical scale, layout, location of facilities, technology used, types of equipment and processes. A critical part of it is a review of the cost estimates and the engineering on which those issues are based.

In institutional appraisal the mission has to evaluate "institutional building" - organization, management and policies, and also the whole array of government policies that condition the environment in which the institution operates.

Management has become the most important issue in the appraisal during the past years. Cost over-runs and delays can often be avoided with effective and proper management.

At the time of economic appraisal the cost-benefit analysis of alternative project designs is finally reviewed. The project is studied in its sectoral setting. The strengths and weaknesses of public and private sectoral institutions, and key government policies are examined. "Shadow" prices are used routinely when true economic values of costs are not reflected in market prices as a result of various distortions, such as trade restrictions, taxes and subsidies.

Financial appraisal has several purposes. One is to ensure that sufficient funds are available to cover the costs of implementing the project and that there is a financing plan that will make funds available to implement the project as scheduled.

Sometimes appraisal has to be done in several phases. The mission may notice that in spite of the borrower's assurances additional studies and checkings must be carried out. In such a case there is no alternative to breaking off the appraisal.

The mission prepares an appraisal report that sets forth its findings and recommends terms and conditions of the loan. This report is drafted and redrafted and carefully reviewed before the loan is approved by the management of the bank for negotiation with the borrower.

Economic appraisal also includes assessment of project benefits, identification of risks, and environmental effects.

3.2.4 Negotiations and presentation to the board

Negotiations are the stage at which the bank and the borrower endeavour to agree on the measures necessary to ensure the success of the project. They must agree not only on the broad objectives of the project but also on the specific actions necessary to achieve them and on the detailed schedule for project implementation. These agreements are converted into legal obligations, set out in the loan documents.

After negotiations, the appraisal report, amended to reflect the agreements reached, together with the president's report and the loan documents, are presented to the bank's executive directors. If they approve the operation, the loan is signed. The effective date will be reached within 90 days provided that conditions laid down in the loan agreement have been met.

3.2.5 Implementation and supervision

The next phase is implementation of the project, which is the responsibility of the borrower with whatever assistance has been agreed upon by the bank in such forms as organizational studies, training of staff and expatriate managers. The bank's role is to supervise the project as it is being implemented.

The bank has an important watchdog function: to ensure that the loan is used only for the purpose for which it was granted. The main purpose of supervision, however, is to help ensure that projects achieve their development objectives and in particular, to work with the borrowers in identifying and dealing with problems that arise during implementation.

Over the years another central objective of supervision has emerged: to gather the accumulated experience to feed back into the design and preparation of future projects and into the improvement of policies and procedures.

As the final step in supervision, either regular project staff or the borrower prepares a completion report on each project at the end of the disbursement period.

3.2.6 Evaluation

Evaluation is the final phase of the project cycle. It is carried out by the Operations Evaluation Department (OED), which is completely separate from the operating staff of the bank and which reports directly to the board of executive directors. The Evaluation Department prepares an audit report which reestimates the economic rate of return on the basis of actual implementation costs and updated information on operating costs and expected benefits. Annually the OED prepares a concordance to project performance and it reports on all evaluated projects. This enables the project staff to refer to earlier experiences gained from the bank's projects by type of project and by phases of project cycle.

3.2.7 Conclusion

All the bank's projects, as has been pointed out, follow the general project cycle, but there are large variations in cycle time schedules. Also the main issues on which the bank staff has to focus vary from case to case; however, management is always the most important one.

It has been found that the total investment cost of the project has only minor effect, and sometimes none, on cycle timing and on the workload of the bank staff. A large project may need less time and less bank supervision than a small one. The secret is in management, not only in the borrower's company or that of the new one to be formed, but also in management of the consultants, the machine suppliers and possibly the consortia.

3.3 FINNIDA project cycle

FINNIDA, the Finnish International Development Agency, finances development projects, following the official Finnish development aid policy, mainly as grants (87% in 1982); the balance between bilateral and multilateral aid was about 60/40 in the nineteen eighties. During the last years, cooperation between FINNIDA and UN agencies in planning aid to the developing countries has been raised in order to channel the aid to projects which are properly prepared, economically viable, and of greatest benefit to the project and the country in which it is located.

Finnish aid is directed to using those resources which Finland has and with which the Finns are experienced. Forest industry is one of these. Because most of the aid is bilateral, it flows mainly through governments and it is often channelled to government-owned companies. However, there is no rule which would eliminate a private enterprise as a recipient.

The FINNIDA project cycle largely follows that of the World Bank, but some issues included in the bank's implementation and supervision phase are specified in more detail. The phases of the cycle are: identification, preparation, appraisal, negotiations and decision, selection of consultants, project agreement, procurement, implementation and supervision, interim evaluation and final evaluation. (See Fig. 1.)

FINNIDA has limited administrative resources, and therefore external specialists and consultants are often used for preparation and to assist the staff in the appraisal and evaluations, as well as in project design, implementation and supervision.

4. TOTAL INVESTMENT COST

4.1 Introduction

The total cost of an investment project, or capital cost, can vary greatly despite similarities in the main production characteristics. Several factors affect cost and their total effect may be crucial. There are examples in both industrialized and developing countries that show that the cost of a medium-sized plant, e.g., for 30 000 m^3 of sawnwood and/or plywood per annum, can be three to four times more for one investor than for another. The explanation is to be found in project details which affect not only the investment cost but also other viability factors.

When someone tells you the cost of an investment you might be interested in, always ask for details. Ask about alternatives. An alternative might be much cheaper than the first and suit your purposes just as well.

Economies of scale apply to investments in the mechanical wood products sector; however, the effect is much smaller than in pulp and paper mill investments. In addition, the production cost structure is different in the former. The share of variable costs - raw materials, labour, etc. - is larger and has a greater effect than fixed costs related to investments, e.g., on a project's profitability.

The mill complex for about 30 000 m^3 of sawnwood and/or plywood, mentioned above, is used as an example in discussing the investment cost components in the following sections.

4.2 Components of total investment cost

4.2.1 Prefeasibility and feasibility studies

It is customary for the entrepreneur/project owner to include project preparation costs as part of capital investment if the venture is realized. The financial institutions often grant loans for these purposes, which later would be included in the main project financing. The money to be used for these purposes must be in relation to the total investment. For medium-sized plants about 0.1% is often enough, but sometimes three or four times more, or 0.3-0.4% (and up to 1%), has to be expended before the best arrangement is found.

4.2.2 Civil works

Civil works must always be examined as a separate issue even though they would be included in a turnkey contract. Most of the work can usually be carried out using local and domestic sources, and it is important that local knowledge and experience are used. Expensive plant construction must be avoided, the methods and materials must be practical and good enough for their intended purposes.

There are sometimes great variations in cost estimates for civil works. This is often due to unfamiliarity with local circumstances. Unfortunately, if the high estimate is to be accepted, it may happen that the money is used inefficiently. No rules can be found for a reasonable proportion of costs for civil works. Experience shows that in countries with a cold climate some 20% of the total investment would be used for

civil works in sawmill and panel mill investments, but in tropical and subtropical countries the corresponding cost would be less, say, 10-15%.

4.2.3 Mill equipment

Mill equipment should be grouped according to mills or departments, and the costs should be estimated as at the mill site. Sufficient funds for spare parts must be included in the costs. Equipment costs are always the major part of the total investment. In mechanical medium-sized wood product plants they should be rather closer to half than to a third of the total figure; but much depends on issues which may increase the total investment.

4.2.4 Equipment installation

Equipment installation is an important phase of mill construction and needs skilled labour and experienced supervision. Often, but not always, the company delivering the equipment can also take responsibility for installation, and sometimes this is done by subcontractors. About 15-25% of the costs for equipment and spare parts in sawmills and panel mills is needed for installation.

4.2.5 Engineering and management

The engineering functions include the preparation of all flow diagrams and layouts and the drawing up of specifications for equipment and construction. They also include the issuing of tenders for equipment, evaluation of bids entered by contractors on the basis of tenders, and the negotiations and finalizing of contracts with contractors. Once contracts for equipment have been granted, it is necessary to retain an inspection and expediting service to ensure that the equipment is in fact being manufactured in accordance with specifications and that the schedule of delivery dates is adhered to.

This needs well organized and active management which controls the work performance, follows the agreed schedules and guidelines and solves any problems rapidly. Some 20% of civil works and mill equipment costs is needed for engineering and management.

4.2.6 Forestry and transportation equipment

These items depend largely on local circumstances and infrastructure. Sometimes it is possible to use local contractors for forest operations and transport of raw materials and products. In such a case the investment would be relatively small. However, in most cases fairly large investments are needed compared with the investment costs for mill equipment.

4.2.7 Infrastructure

When a production plant is to be constructed in a remote area, the entrepreneur may be faced with a number of additional expenditures because of the lack of infrastructure in the area. In addition to housing for personnel there may be a number of other cost items such as access roads or railway, power and telephone lines, schools and hospitals. In many situations a government may assist and participate in providing these.

4.2.8 Physical and price contingencies

The amount of physical contingencies required depends on the accuracy of the investment estimate. A preliminary estimate might need 15-20% of the base-cost estimate (see section 4.3) for unforeseen expenditures, but

if the estimate is based on a turnkey contractor's calculations, physical contingencies can be small, e.g., 5%.

Price contingencies depend on estimated price changes in the project country and in countries from which the equipment would be ordered. These are usually affected by the time factor. Sometimes fixed prices may be used, especially when the construction period is short.

4.2.9 Working capital

Working capital is the investment required to provide enough materials and cash for the mill to operate. The items normally included in working capital in the wood sector are as follows:

(i) Inventory of logs and other wood raw materials;
(ii) Inventory of glue and chemicals;
(iii) Inventory of fuel;
(iv) Inventory of operating and maintenance supplies;
(v) Sufficient funds to cover product inventories and the value of the accounts receivable from products at mill cost;
(vi) Cash reserve to meet fluctuations in payments;
(vii) Cost of prepaid expenses such as wages, prepaid supplies and freight, and insurance premiums.

It is common for a part of the working capital to be financed by short-term credit from commercial local banks and not be included in the net working capital.

Depending on local circumstances, the investment needs for working capital can be quite different for projects of similar scope. For domestic raw materials, e.g. logs, the inventory depends mainly on arrangements for forest operations but for imported materials, chemicals and supplies the crucial issues for determining the inventory are external transportation and several other factors not controllable by the mill management. An example of developing the working capital is illustrated in Table 3.

4.2.10 Pre-operational and start-up expenses

Prior to the start-up of the mill, money must be spent on a variety of activities necessary for the mill's operation. Most are administrative in nature and include the following: (i) salaries for mill management and supervisory personnel prior to start-up; (ii) hiring and training expenditure for mill operating staff; (iii) preparation of manuals and operational and financial control systems; (iv) miscellaneous administrative costs such as office, travel and legal expenses and property taxes. In addition to these, money is required to cover mill start-up costs.

4.2.11 Interest during construction

The time involved in constructing a sawmill or panel mill may be one year or more, depending on its size, type and location. The owner of the mill must use loans for payments and equipment orders even before construction starts and substantial interest costs will also be incurred.

These costs are usually capitalized to reflect the true costs of getting the facilities into operation. By estimating the amount of interest during construction the ratio between equity and loans can be considered. If, for example, the ratio is 40/60, and the time needed for installed cost is one year before operations start, and the annual interest rate is 10%, the interest during construction would be 6% on installed cost.

Table 3

EXAMPLE OF DEVELOPMENT OF WORKING CAPITAL
BY USING THEORETICAL MONETARY UNITS

	Inventory period (weeks)	Working capital year-end amount - monetary units				
		Production starts				Full production
		1st year	2nd year	3rd year	4th year	5th year
(Production capacity)		(0 %)	(50 %)	(70 %)	(90 %)	(100 %)
Inventories						
- logs	(8)	24	38	50	60	86
- sawnwood	(10)	-	52	100	152	200
- panels	(10)	-	100	200	352	440
- operating and maint. materials	(24)	26	38	40	40	40
- glue and other chemicals	(24)	50	76	88	108	108
Total inventories		100	304	478	712	874
Housing		6	6	6	6	6
Sub-total		106	310	484	718	880
Accounts receivable						
- sawnwood & panels	(4)	-	26	50	100	126
Cash		54	70	90	100	126
Sub-total		160	406	624	918	1 132
Accounts payable						
- wages	(2)	-	6	24	118	132
- supplies and freight	(4)					
WORKING CAPITAL:		160	400	600	800	1 000
Less portion financed by short-term debt		80	200	300	400	500
NET WORKING CAPITAL		80	200	300	400	500

Assumptions:
- Sawmill and panel mill project located in a remote area.
- Production capacity 30 000 m^3/year sawnwood and plywood.
- Working capital at full production 1 000 monetary units.
- Production will start during the 2nd year and reach full capacity during the 5th year from investment decision.

Table 4

EXAMPLE OF TOTAL INVESTMENT COST ESTIMATE
BY USING THEORETICAL MONETARY UNITS

	% For	% Loc	Monetary units Foreign	Local	Total	Range of Total
Prefeasibility and feasibility studies	100	-	2	-	2	(1 - 4)
Civil works	70	30	83	35	118	100 - 150
Sub-total			85	35	120	100 - 150
Sawmill	100	-	120	-	120	
Panel mill	100	-	160	-	160	
General services	100	-	70	-	70	
Equipment and spares			350	-	350	300 - 500
Equipment installation	65	35	26	14	40	30 - 100
Engineering and management	90	10	54	6	60	50 - 150
Total plant cost			515	55	570	480 - 900
Forestry equipment	100	-	40	-	40	}
						}50 - 150
Transport equipment	100	-	20	-	20	}
Infrastructure	50	50	40	40	80	50 - 100
Base-cost estimate			615	95	710	580 - 1 150
Physical contingencies			70	10	80	50 - 100
Price escalation			70	10	80	80
Installed cost			755	115	870	710 - 1 330
Working capital	25	75	16	49	65	50 - 100
Pre-operational and start-up expenses			-	15	15	10 - 50
Total project cost			771	179	950	770 - 1 480
Interest during construction	100		50	-	50	50 - 100
Total investment cost	82	18	821	179	1 000	830 - 1 580

Assumptions:
- Sawmill and panel mill project located in a remote area.
- Production capacity 30 000 m^3/year sawnwood and plywood.
- Total investment cost on an average 1 000 monetary units.
- Infrastructure: only housing.
- Price escalation: 10% annually; on base-cost estimate and physical contingencies; one year.
- Working capital structure according to Table 2.

4.3 Investment cost summary

An example of the total investment cost for a 30 000 m^3/year mill is presented in Table 4. In addition to components discussed in previous paragraphs, the costs must be divided into local and foreign currency components for further analysis. Every effort is usually made to save foreign exchange by directing purchases to domestic suppliers if they have the capacity and experience to undertake the work. A high proportion, approximately 80-85% of the total cost (82% in the example in Table 4) must be met by foreign exchange payments if industrial and technical capability is at a low level in the developing country.

The breakdown of investment cost varies greatly from enterprise to enterprise. It depends on the nature of the project and the method in which the project is financed and executed. For example, a project executed on a turnkey basis may show no engineering costs at all because the charges have been included in the overall mill costs. A project financed entirely from equity funds with no borrowing at all will show no interest during construction.

5. TENDERING AND TENDER EVALUATION

5.1 Introduction

Project results depend largely on arrangements for procurement. All factors which affect results should be considered and carefully evaluated. For example, if only the equipment price or delivery time are considered, the decision may not be a good one for the project as a whole, and may lead to an unsatisfactory economic result.

The objective in all procurement work must be an economic arrangement and long-term profitability for the project. For this reason the procurement process must be systematic and well considered in detail. Earlier experience with similar projects is useful and valuable, and if such experience does not exist in the organization it must be brought in.

In order to receive tenders which can be evaluated well and lead to favourable contracts, invitations to tender should be specific in detail, and include the following: background information on the project, objectives, form and conditions of contract, technical specifications with quality and capacity requirements, and other information which might affect the tender. All the information must be collected into tender documents.

5.2 Types of contracts

In the mechanical wood manufacturing sector the basic types of contract can be divided into three categories: (i) lump sum, (ii) unit price, (iii) cost plus contract.

The lump sum contract states one total price for the whole contract and needs no recalculation or adjustment.

In unit price contracts the prices are given separately for different items, and the final price depends on the number of items needed. Usually when the order is passed the final amount of goods is not known. The presumption in this kind of contract is that the budgeting has been done in a professional way.

The cost plus contract refers to price adjustment according to some external factor such as price or cost index. The basic contract price must be recalculated after the goods and/or works are delivered according to contract.

If the whole project is to be under one umbrella, a turnkey contract is drawn up. A turnkey contract can be either lump sum or cost plus orientated or a combination of lump sum, unit price and cost plus contracts. The object is usually a project which will be delivered completely ready: turn the key and the mill/department will start. All responsibility during implementation of the project is the contractor's, and therefore it is easy for the project owner to control.

The issue of responsibility is the most important and most difficult in building up an industry, and for that reason turnkey contracts, which - at least theoretically - cover the issue comprehensively, are commonly used in industrial projects. However, careful technical expediting is required by the owner.

5.3 International competitive bidding

International competitive bidding (ICB) is used in projects financed by World Bank loans or IDA credits. The bank has found that in most cases the following three considerations, which generally guide the bank's requirements, can best be realized through ICB:

(i) The need for economy and efficiency in the execution of the project, including the procurement of the goods and work involved;

(ii) The bank's interest, as a cooperative institution, in assuring all its member countries, developed and developing, and Switzerland, an equal opportunity to compete in providing goods and services financed by the bank;

(iii) The bank's interest, as a development institution, in encouraging the development of local contractors and manufacturers in the borrowing country.

The borrowers must carefully follow the bank's covenants specified in detail in the loan agreement.

5.4 Tender evaluation

When evaluating tenders, price is not the only factor to be considered. Often the most important aspects of the project economy are related to technical appropriateness.

The different aspects should be analysed and evaluated separately and if the technical features are difficult to quantify monetarily, some special method, e.g., a merit point system, can be applied. In this system the various features are relatively weighted or merit pointed. Then the relationship between the quality of the bid and price is established, and price per merit point calculated. The bid which shows the lowest price per merit point should then be selected.

Two-stage bidding is another method which can be used to find the most favourable tender. In the first stage only technical proposals are invited. After the bids are received, their technical merits are evaluated. The most appropriate bid is then selected, and following its guidelines, bid specifications are prepared for the final second stage bidding. It is then easy to find the most favourable tender.

6. MANAGEMENT AND ORGANIZATION

6.1 Introduction

The most critical issues in project work are those connected with management. A project can be successful only if management measures up to it; and there is no possibility of getting good results if the management is incapable and inefficient.

Development depends on management in all institutions, companies and countries.

Only a relatively short time ago, all the present industrialized and highly developed countries were in the same phase of development that developing countries are in today. It would be easy to prove that effective and active managers have had a major role in leading their companies and countries into success. It has always been the manager's responsibility to be an example to his organization ... if you are active and have initiative, your organization has it, too.

Two interrelated factors are closely connected with management: responsibility and organization. A manager might feel that the present situation is not the best one, that it could and should be improved, but he says, "It is not possible for me to do anything about it since I do not have enough power". A person who says something like this is not the right one to have on the job. If someone really wants to do something, he can do it. It might take time, but the trend can be changed.

You will get power if you are ready to take responsibility; and you will get responsibility if you only want that.

6.2 Services for management

Project implementation needs several services which can be supplied by (i) a consulting firm, (ii) a suppliers' consortium, (iii) a turnkey contractor, or (iv) the project owner's personnel. The services, not normally needed for an operating company, are as follows:

(i) Project management and total engineering services;
(ii) Basic engineering;
(iii) Detail engineering;
(iv) Checking and/or reviewing the vendors' engineering;
(v) Assistance with procurement;
(vi) Construction supervision;
(vii) Controlling the vendors' construction;
(viii) Test run and start-up supervision;
(ix) Technical and training supervision;
(x) Production (capacity and product quality) supervision by using local workers;
(xi) Marketing, management training and other management services;
(xii) Equity partnership services.

The services listed above (i to xii) can be included in a turnkey contract. The classical contract normally contains the points from (i) to (viii); a plus or heavy turnkey is completed with training supervision; the product-in-hand turnkey means responsibility for production (capacity and quality, using local workers), and the market-in-hand turnkey includes the marketing responsibility too. An equity partnership can be combined with the turnkey contract, and in such a case it will be called a joint venture turnkey.

6.3 Organizational aspects

Some principles of planning and selection of people for industrial enterprises are critical to success and the avoidance of problems.

The first is that the organizational structure must be clear, simple and have only a few levels. The organization must be staffed with experienced, active personnel and the best available specialists.

Secondly, responsibilities and rights must be clearly defined.

Thirdly, the industrial operation must be carried out on a sound commercial basis and, if possible, with private sector participation.

The first two of these principles are well suited for project organization and carrying out project work. An example of the organizational structure of a project is illustrated in Fig. 3. As the group-work will finish with the project, it is important for the sake of continuity that the persons who will be responsible for further operations are included in the group.

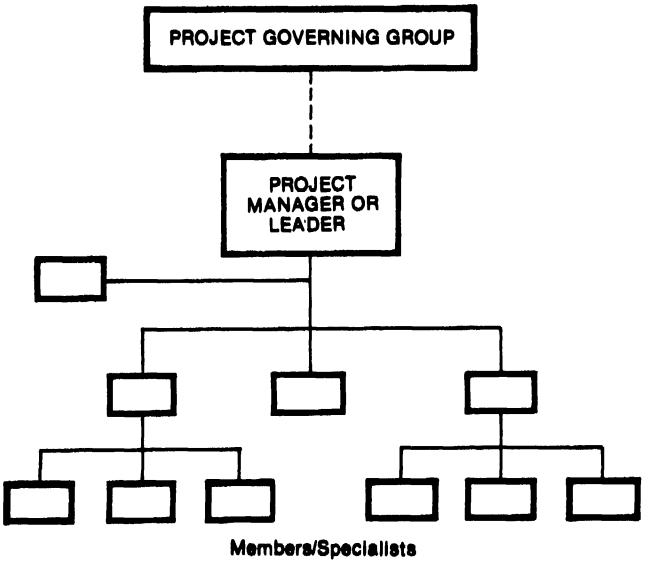


Fig. 3 EXAMPLE OF ORGANIZATIONAL STRUCTURE OF A PROJECT

If a medium-sized or large investment project is implemented using external services, the controlling elements of the organizational structure need special attention. Interrelations among the different organizational bodies are illustrated in Fig. 4.

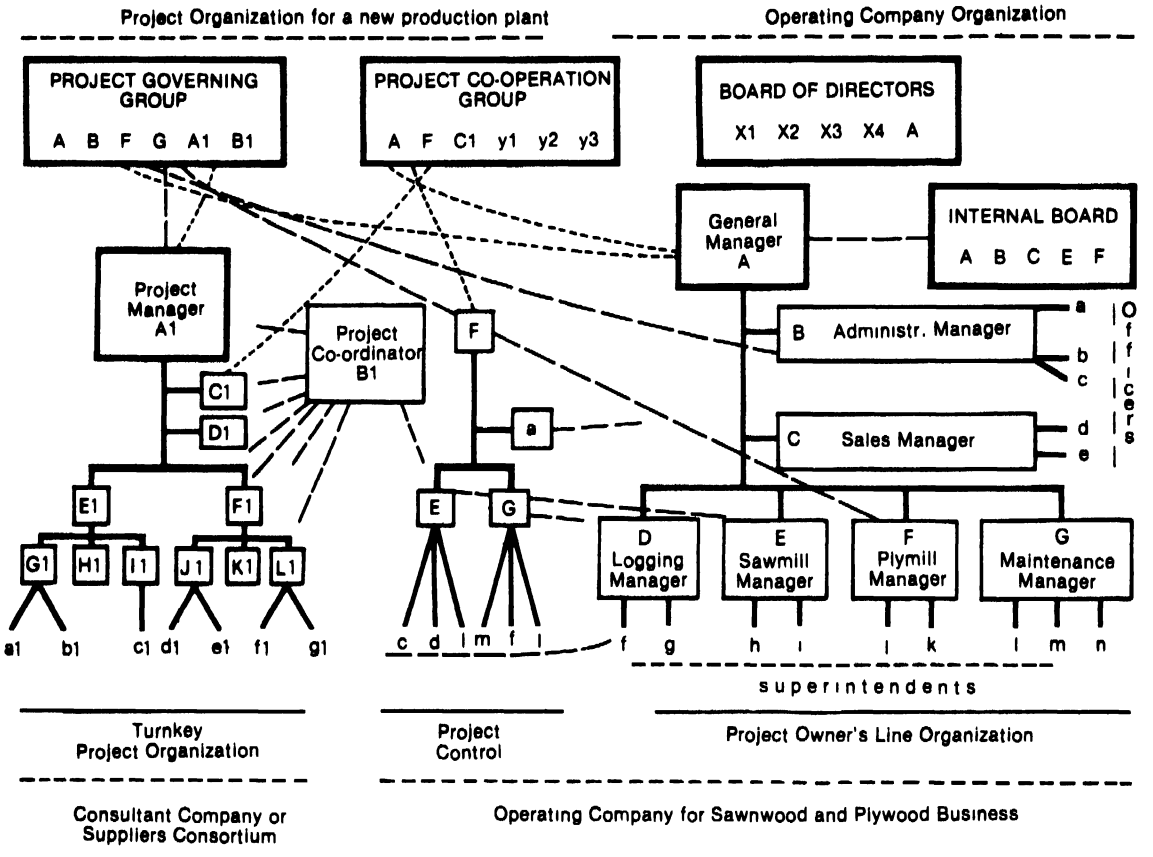


Fig. 4 EXAMPLE OF INTERRELATIONS BETWEEN LINE AND PROJECT ORGANIZATIONS

The operating company in the figure could be a medium-sized integrated sawmill and plywood mill with a production capacity of 30 000 m^3/per annum of sawnwood and plywood. It should be noted that, in addition to its board of directors, the company has an internal board for getting the best results and coordinating operations.

The turnkey project organization (in the example in Fig. 4), is staffed by a consulting company or suppliers' consortium, and the project is governed by a group, headed by the general manager and staffed by two owner's managers, the project manager and coordinator. Continuous control of the turnkey contract is by a separate organization, staffed by the operating company and headed by the general manager. There is also a group for project coordination.

In some countries, like Scandinavia, it is established by law that there must be such a group to provide the necessary information for the parties involved in the project and to give guidelines for implementation of the project.

Part 2. EVALUATION OF A PROJECT

7. INTRODUCTION

A necessary part of project work is evaluation which must start as early as the identification phase and follow through all the phases until the project has shown its viability and has been finalized. This continuous evaluation process is illustrated in Fig. 5.

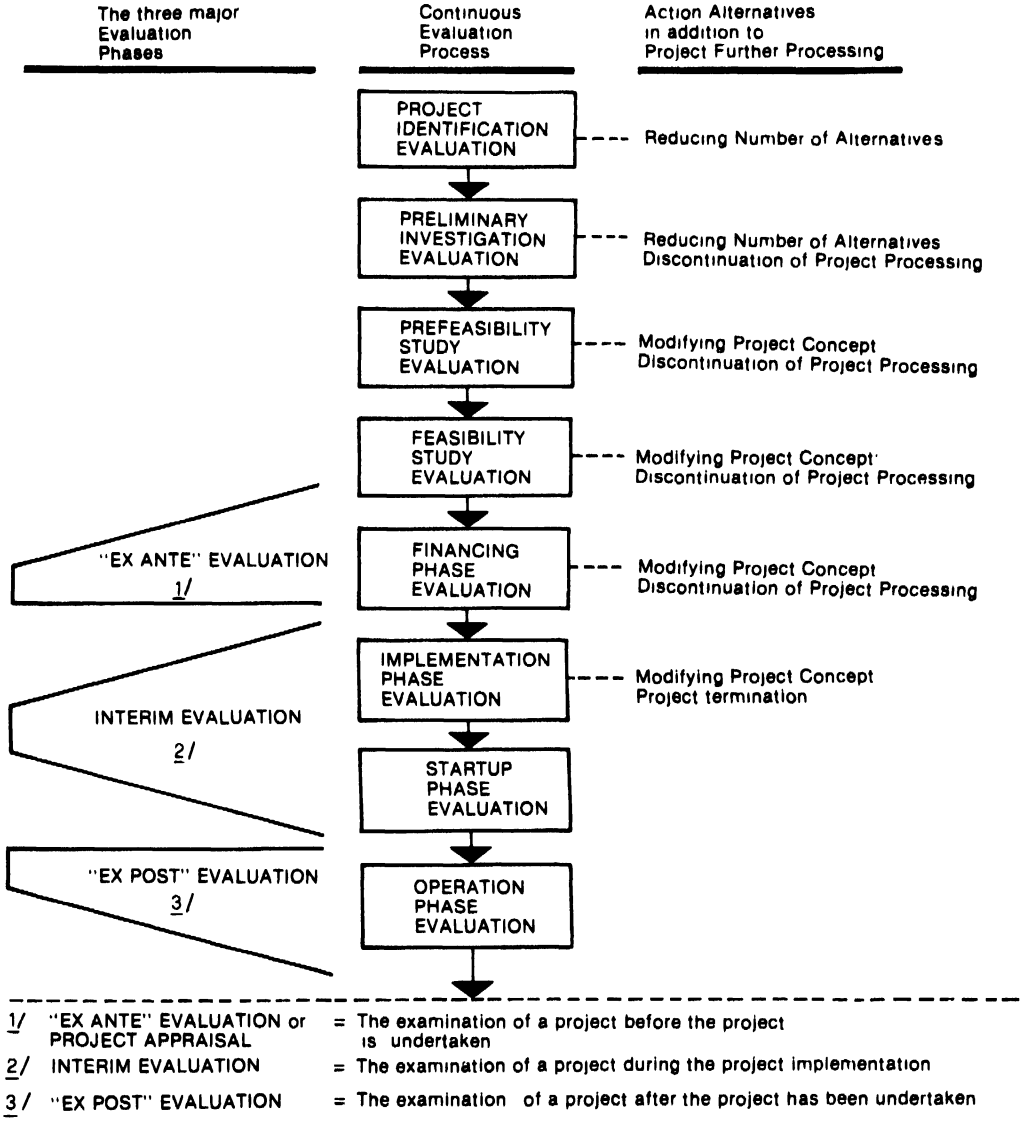


Fig. 5 CONTINUOUS INVESTMENT PROJECT EVALUATION

The three major evaluation phases during the project cycle are (i) ex ante, (ii) interim, and (iii) ex post evaluation.

The first phase covers the examination of a project before it is undertaken. It must be comprehensive of all the factors which would influence the decision on implementation. The World Bank, FINNIDA, and several other financial institutions call this step Project Appraisal (see section 3.2.3).

An evaluation must be carried out carefully and it should be specific enough to provide guidance for the project management. It may, and in certain circumstances must, give clear signals for continuation and acceptance of different phases. Evaluation is one of the main tasks in project organization. It is the responsibility of the project owner.

7.1 Continuous evaluation

7.1.1 Evaluation of project identification

As noted above, the first evaluation process must start during project identification. Depending on how thoroughly the system to be used is analysed and considered, the final result can be either a money-maker or a burden on the country and/or the project owner.

Two groups of owners can be distinguished in project identification: (i) governments and (ii) entrepreneurs. They have different resources and targets in spite of the fact that the main objective in terms of project viability and economy is similar. Because of the different targets an evaluation can have different characteristic features.

Governments in most cases have strong control over natural resources - e.g. forest land - which easily leads to the formation of government-owned enterprises in the mechanical products sector of forest industry. Governments also have the power to make laws and regulations that can provide economic advantages for new enterprises. They can protect markets by tariffs, or subsidize costs, or guarantee loans, and apply these fully or partially as incentives.

A private entrepreneur with limited resources must always take a close look at short-term profitability. He must consider the prevailing regulations and laws; and especially the present situation and predicted trend in the market for the products to be manufactured. He might note that production would create new demand and new markets.

Evaluation during project identification is in most cases only qualitative and comparative. The true result may be different. It depends on available resources and also on how big a risk the entrepreneur is willing to take and capable of taking in the short and long term.

The evaluation process illustrated in Fig. 6 shows how different results can be, depending on the decision-maker's background and resources, in spite of the fact that they are based on the same initial situation.

In the case shown in the figure some investment project ideas were conceived both in a private enterprise and in the government decision-maker's work as both of them had noticed a gap in the domestic panel market. The entrepreneur's limited financial resources affected his evaluation and eliminated alternatives which could have led to a profitable result. In this case, the entrepreneur was not willing to take a large financial risk and rejected the opportunity to own a large panel factory in the future.

The desires which affected his evaluation were: (i) to increase his present business, (ii) to avoid running into debt, (iii) to make products calling for expertise similar to what he already had, and (iv) to make a product which would give opportunities for converting the industry.

The arguments for the government representative were quite different: (i) to increase employment, (ii) to make the best use of wood resources, and (iii) to improve the country's currency situation.

When uncontrolled, evaluation in the early stages will increase risks which could be avoided, but if it belongs to a controlled routine, possibilities for profitable final results will increase.

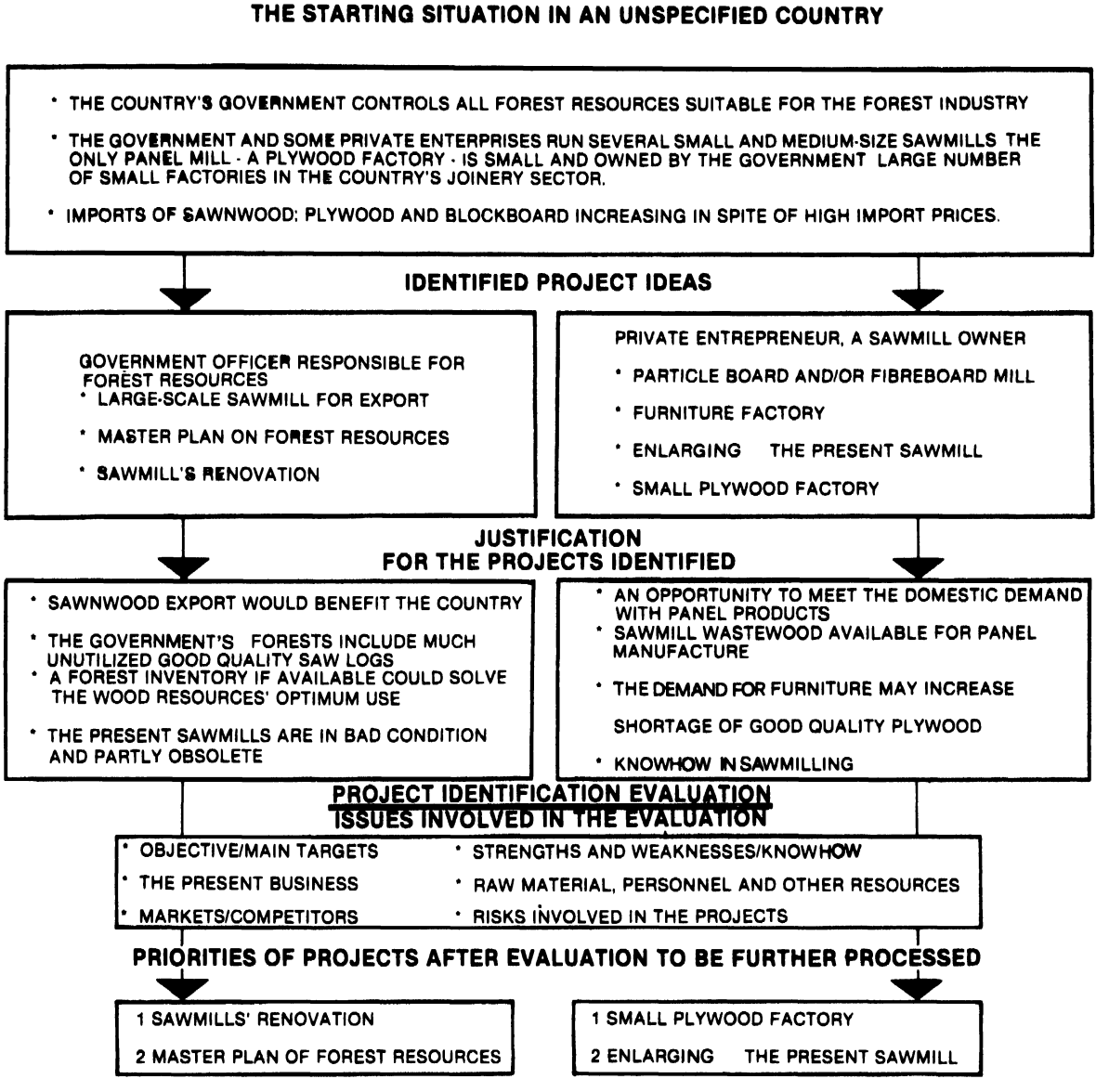


Fig. 6 AN EXAMPLE OF PROJECT IDENTIFICATION EVALUATION

7.1.2 Preliminary investigation evaluation

The next step in evaluation is carried out after the first complete planning study. As pointed out in section 2.3, this is often informal and made by the project initiator himself or with help from representatives of different development agencies such as the World Bank, FAO or FINNIDA.

This phase often delivers a number of new project ideas which must be reduced or at least listed according to priorities. Sometimes the evaluation indicates that it is not advisable to continue with preparation of the project.

In principle, the evaluation must be carried out in the same way as the previous one. but in more detail. Therefore, more external advice and information are needed. It is advisable to discuss the issue with available specialists, bank representatives, machine manufacturers' representatives in that area, and competitors.

Rough market trend analysis and cost and profitability calculations should also be made to avoid unnecessary study costs later.

The essential issue in the evaluation, however, is to clarify one's own targets and objectives, if this has not already been done. They must be the leading issues in evaluation and all activity. Business opportunities in the forest industries mechanical products sector are too diversified to lead to good results unless there are clear targets and objectives.

7.1.3 Other continuous evaluation phases

As evaluation must continue through the whole project cycle it is relatively easy to specify the activities according to project phases. All projects are specific and it is the project owner's task to decide which system and which evaluation phases to include in the control. It is unwise to follow a method which is too theoretical for the project organization and which goes over their heads. The evaluation should be simple but exact and specific enough to give the right signals.

Generally speaking a small investment project needs a simple system, a medium-sized one, a more complicated control system, and a large project needs the most complicated evaluation of all. Sometimes, however, a small project - or one which has been regarded as small - needs a large evaluation. This issue will be covered in more detail in the workshop's case studies.

Sometimes, the choice of a system does not depend only on the project owner. If the project needs external financing - and this is generally the case with medium- and large-sized projects - the evaluation system to be used depends largely on the financier's requirements. Ex ante evaluation (appraisal) will probably be included in the project cycle in some way.

8. EX ANTE EVALUATION OR PROJECT APPRAISAL

8.1 Introduction

Ex ante evaluation is usually carried out by a prospective financier before the project is undertaken. In such a case it must include all the essential elements of the project in order to find out whether the project is sufficiently attractive to be financed.

However, irrespective of whether financing is needed, the appraisal should be handled in detail and systematically by the project owner. For medium- and large-sized industrial projects in the mechanical wood sector at least the following factors must be included in an ex ante evaluation: (i) markets and marketing, (ii) the equipment and technology used, (iii) infrastructure, (iv) management and training, (v) capital cost, financing plan and procurement, (vi) financial analysis, (vii) economic analysis, and (viii) risks and benefits.

Markets and marketing are an important issue in evaluation. In the mechanical sector the domestic market situation must usually be the guiding factor; and in addition to the present situation the market trend must be projected and analysed over the long term. Marketing risks will always exist and must be considered.

The scope of the project and planned technology depend on local conditions. Often when an inexperienced group has been involved in planning, the technology recommended is not applicable or not the best.

The success of a project always depends on management, as noted earlier. Unfortunately, sometimes there are no experienced managers; and sometimes weaknesses appear during a critical phase. It must be made clear that in such a case the project owner takes all the risks which might result from failure.

8.2 Financial analysis

The object of a financial analysis is to prepare the necessary calculations and estimate the measures of worth which permit the entrepreneur, potential equity investors and potential lenders of capital funds to make their decisions on investment.

The analysis is based on different assumptions. For a new production plant, for example, the following estimates must be made:

- Production and inventory schedule;
- Production cost estimate;
- Capital cost estimate (and depreciation);
- Terms of borrowed capital (structure and cost of loans and repayment periods).

By using assumptions, the following statements (say, for a 15-year period) can be prepared:

- Projected income statements;
- Projected cash flow statements;
- Projected balance sheets;
- Cost and benefit streams.

The financial rate of return is an important indicator of a project's viability, which can be calculated from cost and benefit streams. To be financially viable a project should show an internal rate of return (IRR) percentage which is higher after taxes than the rate of interest on loans.

In addition to IRR (before and after taxes) several other indicators such as the following are used and should be reviewed in analysing risks:

- Gross profit (before any provision has been made for depreciation, interest on funded debt and income tax);
- Gross return on total investment;
- Net profit before income taxes;
- Net profit after income taxes;
- Net return on equity investment;
- Net return on sales;
- The interest coverage ratio;
- The debt service ratio (or coverage);
- The current ratio;
- The ratio between long-term debt and equity;
- The pay-out period (or payback period);
- The break-even point.

A sensitivity analysis should always be included in the examination. A common way is to compare the IRR against the major risks. The results can be illustrated with numbers, or by using the method shown in Fig. 7.

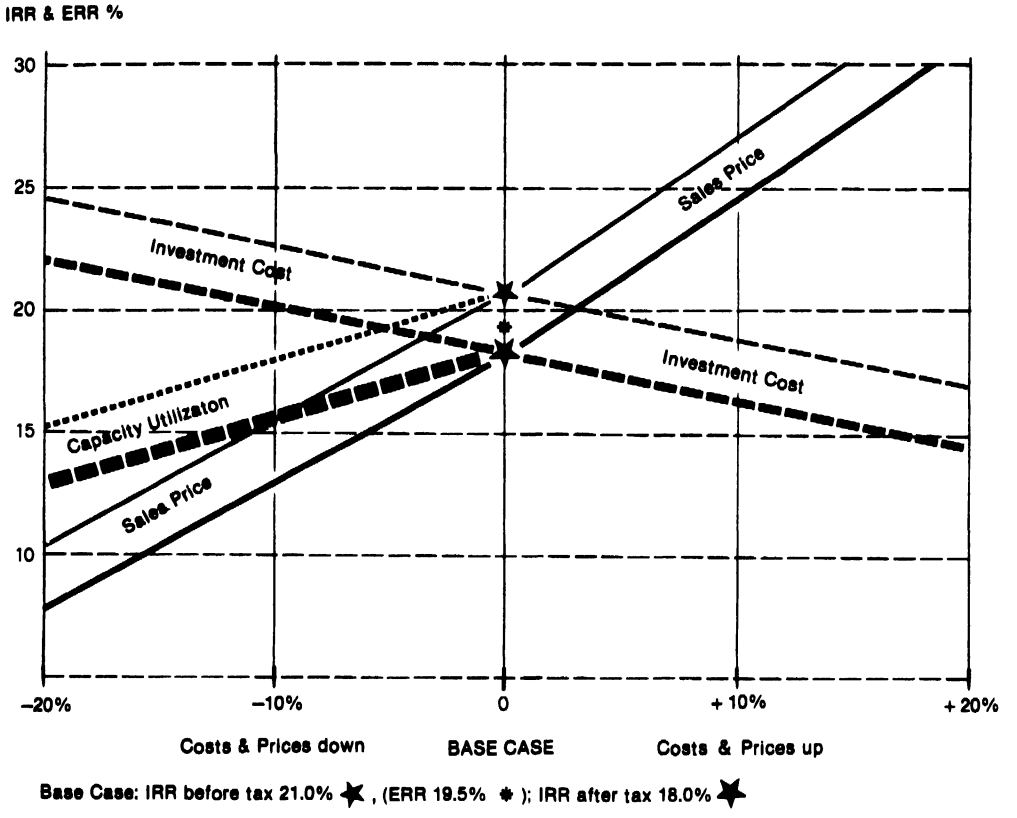


Fig. 7 EXAMPLE OF FINANCIAL SENSITIVITY OF IRR
(FOR A MEDIUM-SIZED SAWMILL - PLYWOOD MILL PROJECT)

8.3 Economic analysis

The economic analysis of a project is aimed at determining whethe that project is consistent with overall national and sectoral objective and whether the investment proposed represents the best means of achievin the intended objectives. The analysis is based on the same components a the financial one, but it differs from the latter both in terms of identi fication and in evaluation of inputs and outputs and therefore in th composition of cost and benefit.

The benefit from a project is the extent to which the end-produc contributes to the achievement of its objectives. Cost reflects th degree to which the achievement of those objectives is sacrificed b diverting the resources required by the project from alternative uses.

If the benefits of a project exceed the costs, the indication is tha its implementation would make a positive net contribution to aggregat output in the country. If costs exceed benefits, such a project reduce welfare, and in the interest of the country it should not be supported.

Economic rate of return (ERR) calculations can be made by adjustin financial cost and benefit streams to economic ones. In mechanical woo products sector projects, the following adjustments must be taken int account:

- All domestic taxes, duties and subsidies must be eliminated fro prices and costs. This usually affects both capital and productio costs.

- If there is unemployment in the country, unskilled labour costs must be shadow-priced.

- If timber has only limited uses as a raw material in the country its economic value can differ from its (theoretical) market value.

- Product price must be an international market price and equal to imported CIF price.

- The cost of foreign exchange can be higher than that indicated by the official rate.

There are always numbers of other useful project benefits which cannot be quantified in the ERR analysis, but which must be taken into account. In this connection, the following issues must be checked:

- Country development;
- Employment and training;
- Industrialization.

9. INTERIM EVALUATION

9.1 Continuous interim evaluation

The examination of a project during its implementation is called interim evaluation. It is one of the owner's tasks to set up a system of control which continuously gives information on progress and checks how closely the plans are being followed.

There are several methods which could be applied to local conditions. The more complicated and large systems might cause difficulties in medium-sized and large projects, and therefore should be avoided for that use. It is important that the system, large or small, gives an appropriate and immediate signal to the controller if the plans are not followed. Action to correct the situation should be taken immediately in order to avoid unnecessary losses.

Sometimes conditions change during implementation of the project, and result in a need to change its scope and/or schedule. In such a case, the controlling system must give a signal to the owner or his representative. A comprehensive evaluation of the whole situation might be needed and in that case it is the owner's responsibility to react appropriately.

Two components, work progress and project cost, must get special attention when the evaluation system is planned. The system should include at least the following functions, clearly planned and defined:

(i) Progress schedules and/or diagrams
manual schedules to plan and follow up the progress of work are in most cases sufficient in small and medium-sized projects;

(ii) Progress meetings
for decision-making and reacting to evaluation signals;

(iii) Progress reports
with evaluation signals, for the attention of the appropriate persons.

In addition to work progress and project costs, several other sub-components closely related to these must be continuously checked, e.g. the project work force and contractors' progress. Often the signals from these sources give valuable advance warnings of possible trouble and conflicts.

9.2 Formal interim evaluation phase

Financial institutions often have formal interim evaluations during implementation of a project. They may be called supervision (WB and IFC) or mid-term evaluations (FAO) or interim evaluations (FAO and FINNIDA).

The WB's supervision, as noted in section 3.2.5, is in several respects an essential part of the WB project work. The WB will simultaneously evaluate a project and give assistance to borrowers.

According to the WB the "main purpose of supervision is to help ensure that projects achieve their development objectives, and in particular to work with the borrowers in identifying and dealing with problems that arise during implementation. Supervision therefore is primarily an exercise in collective problem solving and, as such, is one of the most effective ways in which the bank provides technical assistance to its member countries."

FAO's and FINNIDA's interim evaluations are carried out at least once during project implementation, often at the mid-term of the schedule. As the project progresses, if it is noticed that there are large problems or changed conditions which indicate that the project will need assistance from its financiers, an additional interim evaluation can be arranged.

The interim evaluation work is carried out by a group, an evaluation mission selected by the institution. The country authorities are asked to cooperate with the mission and their representatives are asked to work as mission team members.

Terms of reference for the mission are prepared by the relevant institution. They might specify the following activities:

(i) Examination of progress by comparing actual inputs, activities, outputs and achievement of objectives against plans;

(ii) Analysis of the information collected to determine effectiveness, efficiency and relevance of the project;

(iii) Deciding whether, on the basis of the information collected and its analysis, there are actions to be taken or proposed;

(iv) Proposing actions needed by the relevant institution;

(v) Preparing a summary report.

The evaluation mission must produce information and/or proposals needed to analyse the project situation and possibly decisions to solve problems identified in the evaluation.

10. POST EVALUATION

Post evaluation is carried out after the project has been completed, to give information on plans realized , feedback from the work and lessons for future projects. It should be included in the normal work of all organizations, and not only financial institutions, where post evaluation is commonly the last phase of a project cycle.

The object of post evaluation is similar in all organizations, which need to be informed on the economic results and the impact of the project. The result is often different from the one planned, before it was decided to implement the project. It is important to know the reasons for the differences; and this is why a comprehensive evaluation must be made.

Only by these means can information about pitfalls be gathered in order to avoid them in the next project. The scope of a post evaluation report is given below.

EXAMPLE OF THE SCOPE OF A POST EVALUATION

(i) Summary
- The economic result
- The major differences between the plans and reality;

(ii) Lessons for future projects;

(iii) Evaluation aspects
(the major differences which affect final results/the reasons for the differences/influence on the results)
- Overall economic situation
- Technical project scope/manufacturing process/project location
- Financial aspects/capital cost/financing/manufacturing cost
- Commercial aspects
- Management and organization
- Policy aspects;

(iv) Financial analysis;

(v) Economic analysis.

11. COMMON PITFALLS IN PROJECT WORK

Project work needs much experience, initiative and activity in order to avoid pitfalls on the way, which may affect the economic and other results. It is a good rule to prepare the project with care and to follow advice and seek assistance from people who have been involved in similar projects, if possible, in similar conditions to the present one.

The following list of possible pitfalls may not be valid in all conditions. It is not focused on any specific country, organization or consultant:

(i) Management weaknesses

Almost all trouble and economic losses could be avoided by capable management. It is the management's responsibility to be prepared for unpredicted difficulties and troubles.

It must be kept in mind that, if you are a manager, you must be an example to your organization. You must avoid misjudgements in your own activities.

You must know your own managers and their capability. If experience is lacking, increase it. Sometimes a contract with a consultant firm could be the right way to strengthen management and avoid risks.

(ii) Lack of training

In addition to capable managers a successful mill operation needs skilled workers. Training needs must be considered at an early stage of project implementation.

Avoid external, foreign trainers and use your own managers wherever you can. You and your managers must take the responsibility for training.

(iii) Organizations staffed with unqualified persons
An organization must be an effective tool for the managers and give a clear guide of how to work. An unqualified person in the organization causes more trouble than if the post had been left unfilled.

(iv) Inability to use local resources effectively
This could be a managerial issue, or connected with local traditions. In both cases it is the management's responsibility to correct the situation.

(v) Denying own mistakes
Every person makes mistakes, and it is not shameful to recognize your own. If you lay the blame for your mistakes on another person, you will run into problems.

(vi) One solution principle
In order to make a correct decision, you must have alternatives to evaluate. Remember that your idea might not be the right one and that the proposals of others must be evaluated and considered. It is also important to ask for alternative proposals for technical and other solutions in project work.

(vii) Weak knowledge of competitors
You must accept that your competitors operate in the same area as you. But you must also know how they operate and avoid traps that they might set for you. Be honest with your competitors, but do not tell them your trade secrets.

(viii) Lack of activity
Activity in your organization, among your group, can be increased with your actions. If you find an inactive person, he may be in the wrong post or he may have the wrong superior.

(ix) Weak cooperation
Cooperation, team work in a project, is essential for good results. If it is lacking, difficulties increase.

(x) Weak planning
Weak planning will affect the whole project and is not acceptable in a project. If weaknesses are found, they must be corrected, even though this would delay implementation.

(xi) Wrong technology applied
The technology to be applied must suit local conditions. Risks are always involved in accepting prototypes (unproven technology).

(xii) Overestimated costs
Overestimating cost is as risky as underestimating. It is easy to broaden safety margins by listing unexpected costs. However, if listed, they will usually be realized.

12. INDIVIDUAL INITIATIVE

Individual initiative is an important property in project work. No project can be managed successfully and obtain good economic results without personnel initiative and especially management initiative.

Two projects, at their start, could have the same opportunities and similar resources; but one would succeed and the other not. The reason is often in differences between the managers and their initiative.

Almost all the difficulties and problems which affect project work could be avoided, or at least their negative effects could be decreased, by management action based on initiative. Initiative can be created, if an effort is made.

Be initiatory, create your own initiative, and you will profit your own organization, your environment and your country.

Peeling lathe (Photo: H. Seppanen)

Appendix 1

PRINCIPAL ABBREVIATIONS AND ACRONYMS USED BY FINANCIAL INSTITUTIONS

ADFAED	The Abu Dhabi Fund for Arab Economic Development
AFDB	The African Development Bank
ASDB	The Asian Development Bank
BADEA	Banque arabe de développement des Etats africains
CIDA	Canadian International Development Agency
DAC	Development Assistance Committee
DAF	Development Assistance Fund
DMC	Development Member Countries
ECE	Economic Commission for Europe
ECOSOC	Economic and Social Council of the UN
EDF	European Development Fund
EEC	European Economic Community
EIB	European Investment Bank
FAO	Food and Agriculture Organization of the United Nations
FINNFUND	Finnish Fund for Industrial Development Cooperation Ltd.
FINNIDA	Finnish International Development Agency
GTZ	German Agency for Technical Cooperation
IBRD	International Bank for Reconstruction and Development (The World Bank)
IDA	International Development Association (The World Bank)
IDB	Inter-American Development Bank
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation (The World Bank)
ILO	International Labour Organization
IMF	International Monetary Fund
ISDB	Islamic Development Bank
ITC	International Trade Centre
KfW	Kreditanstalt für Wiederaufbau
ODA	Overseas Development Administration
OECD	Organization for Economic Cooperation and Development
OED	Operations Evaluation Department (The World Bank)
OPEC FUND	OPEC Fund for International Development
SIDA	Swedish International Development Agency
UN	The United Nations
UNCDF	United Nations Capital Development Fund
UNCTAD	United Nations Conference for Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
Unesco	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations Children's Fund
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
WFC	World Food Council
WFP	World Food Programme
WB	The World Bank
WHO	World Health Organization

Appendix 2

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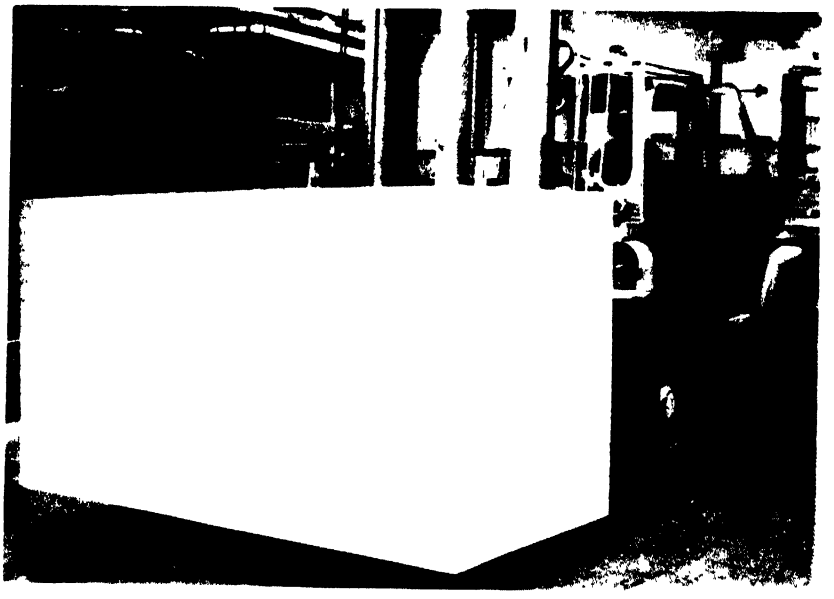


Plywood on its way to storage (Photo: H. Seppanen)

Storage of panel products (Photo: H. Seppanen)

ORGANIZATION AND MANAGEMENT OF FOREST INDUSTRY CORPORATIONS

by

Olavi Karttunen, Vesa Viitamaki and Hans Södergård
Oy Mec-Rastor Ab

1. THE ORGANIZATION PATTERNS OF FOREST INDUSTRIES

1.1 The scope of activities to be organized

The forest industry sector is not a homogeneous, one-dimensional entity. Before we can start to discuss organizations in this sector we have to understand the possible complexity of the business.

In broad terms, the following are the factors which are involved in an organizational study of the forest industry sector:

- Raw material sources (nurseries, plantation)
- Harvesting (logging, skidding, transportation)
- Production lines, e.g. the following:
  - . sawmilling (softwood or hardwood)
  - . plywood manufacturing
  - . board product manufacturing (chipboard, hardboard, particleboard)
  - . pulp manufacturing (chemical, semi-chemical, thermo-mechanic pulp)
- Further processed product manufacturing (doors, furniture, panels)
- Sales and marketing (domestic and export)
- Maintenance (in various functions)
- Administration (financial, manpower, etc.)

In the following pages examples of different organization patterns are formulated for companies operating in the mechanical wood industry without their own forests but selling their own products. The same examples may apply to the chemical wood industry.

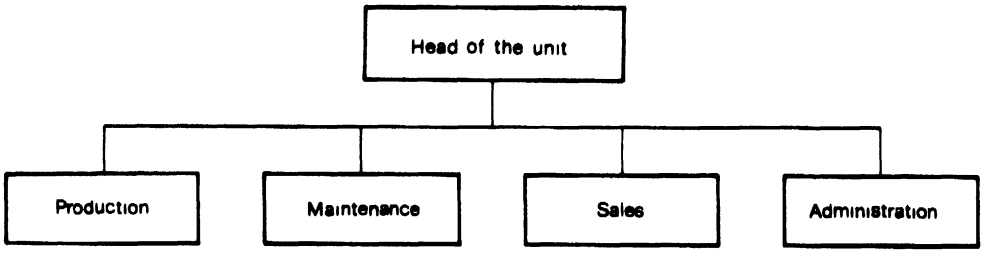
1.2 Basic organization structures

There are three basic ways to organize an enterprise:

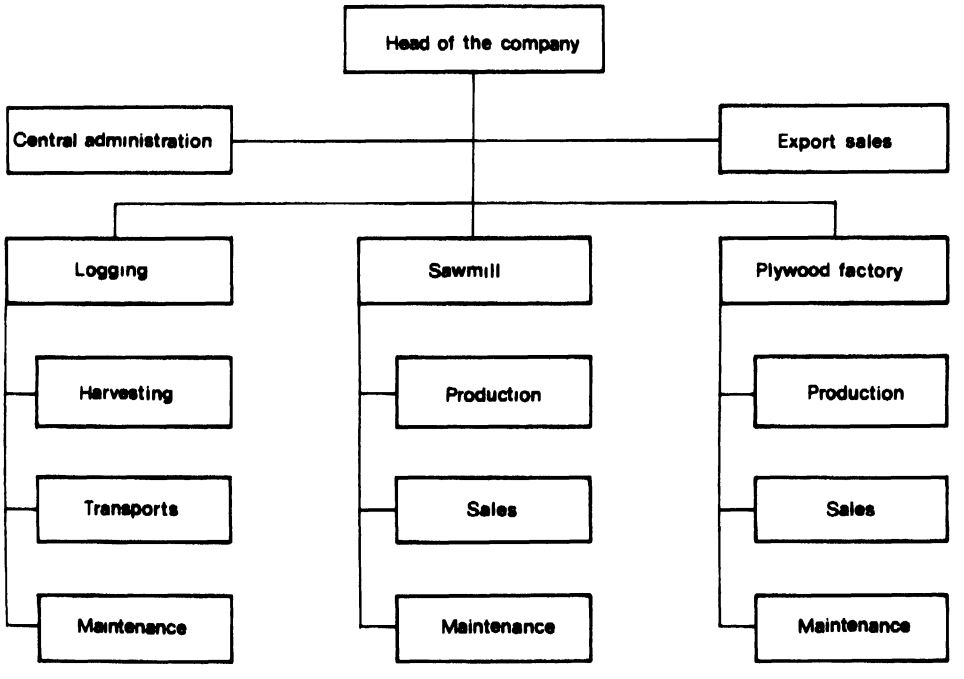
1. functional organization
2. profit centre organization
3. matrix organization.

In a functional organization the head of the company or unit is responsible for the profitability of the unit. Under him the responsibilities are normally divided according to the main functions. The subordinates are responsible for the efficiency and costs of their subunits but the economic results can be accounted for only at company level.

The organization chart might look as follows:

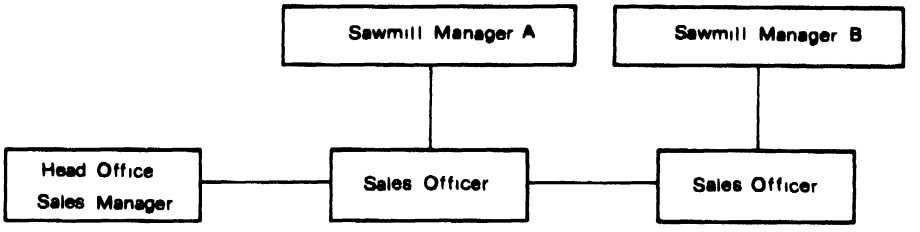


In profit centre organization, the responsibilities for profitability are divided among the heads of profit centres and the total profitability can also be accounted for at company level. Before you can call a unit a profit centre certain conditions must be fulfilled. Briefly, it can be said that the head of a profit centre must have under his control all the parameters which affect the results of that profit centre. Normally, this means that he must be able to handle both revenues and costs independently. Within each profit centre the organizational structure may be functional or, in some cases, divided once more into subprofit centres. To illustrate this kind of organization let us assume that we have a company which consists of two product lines (sawmill and plywood factory). Most parts of the functions are divided into profit centres but some are centralized, in this case administration and export sales.



In this example, logging is also formulated as a profit centre. This means that the logging department has its own costs convening all activities and it derives revenues when it sells logs to the sawmill and the plywood factory.

A matrix organization is the most complex way to organize a company. The rule of thumb is to avoid using a matrix organization whenever possible. In a real matrix organization a subordinate has two superiors with different kinds of expertise. For instance, if both the head office sales manager and the local sawmill manager can give orders to the local sales officer, he is in a matrix situation.



If the corporation by its nature is very complex, some kinds of matrix situations are normally necessary, at least in the sense of coordination and monitoring. If this is the case, the duties and authorities of all parts must be clarified carefully. Especially great emphasis must be put on the clarification of profitability in the matrix situation. The recommendation is that profitability should be accounted through one line only and all other lines should be handled as staff functions.

1.3 Organizations in different kinds of business connections

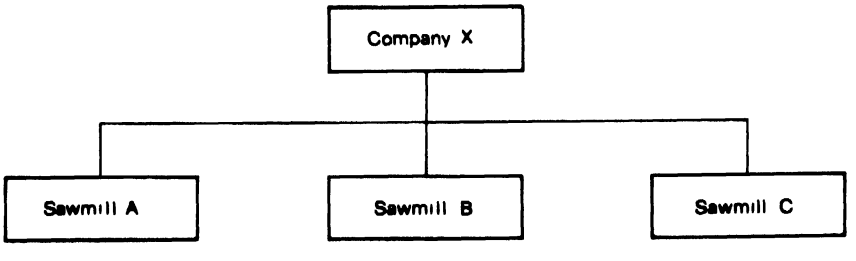
A company operating in the forest industry sector may be merely a one-unit sawmill but on the other hand it can be a large, nation-wide conglomerate operating in many product lines located in various places in the country, or anything between these extremes.

Organizations in different cases are naturally different. The structure of a very simple single-unit company will not be further explained. In most cases a functional organization is the most suitable one for companies, especially if the scarcity of skilled management is a limiting element. In this case, only the managing director needs knowledge of general management and all the others can concentrate on improving their skills in their special functions.

In the case of at least two production lines in the same company, it is more difficult to give recommendations. Production lines may be horizontally integrated (e.g., there are two or more sawmills in the same company or two chipboard units in separate places) or integration is vertical. Vertical integration means that the products of one unit are used in another unit in the same company (e.g. sawmill sends a part of its products to panel production unit or to the door factory, joinery, etc.).

The following diagrams illustrate the integration possibilities.

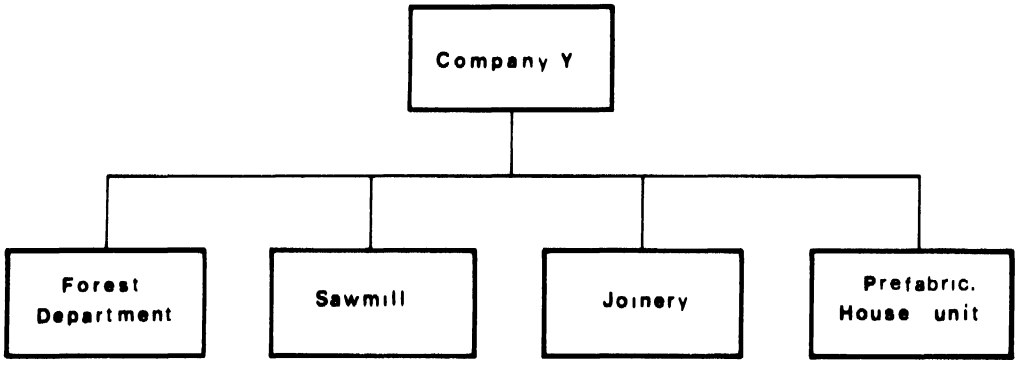
1) Horizontal integration



Horizontal integration means that all business units operate in the same field. The main reasons for this kind of integration are the benefits to be derived from a bigger market share, possibilities in keeping the separate units specialized for a narrow product mix (scale effect phenomenon) and management of many units by the same general and special management, and in many cases also the use of a centralized sales organization.

2) Vertical integration

As mentioned above, vertical integration means that the units are in sequence with each other so that the products or other outputs of one company are raw materials for the second one.



In this example, company Y has its own forest operation, the sawmill uses the logs. The sawmill sells a part of the sawn timber to its outside customers but a part of its products is processed in the joinery belonging to the same company. All or a part of the joinery products is used as raw material in a unit producing prefabricated houses.

These kinds of vertical integration are common in all business areas. Sometimes the chain can be very long starting with raw materials and reaching to the ownership of retail stores.

The reason for this kind of integration may be the desire to control the whole process or the idea of decreasing the costs by avoiding the cost of profits other companies or middlemen might obtain. In some cases, companies have to integrate vertically because a unit which is needed does not exist. Thus the company has to own one part in order to run the business elsewhere.

Concerning the way in which vertical integration takes place: there are two basic possibilities, so-called forward integration and backward integration. Forward integration means that a company opens a business in an area where it can use its own products as raw material, e.g. a sawmill opens a panel manufacturing line or a pulp mill integrates forward by establishing a paper mill. Backward integration is the opposite way to move. If a company operating a prefabricated house business buys a sawmill, this is backward integration.

Normally, in these kinds of companies the basic organizational structure should be a profit centre one. Thus each sawmill should be a profit centre as well as the door factory, the joinery or any other vertically integrated unit. Within the units functional structures are recommended.

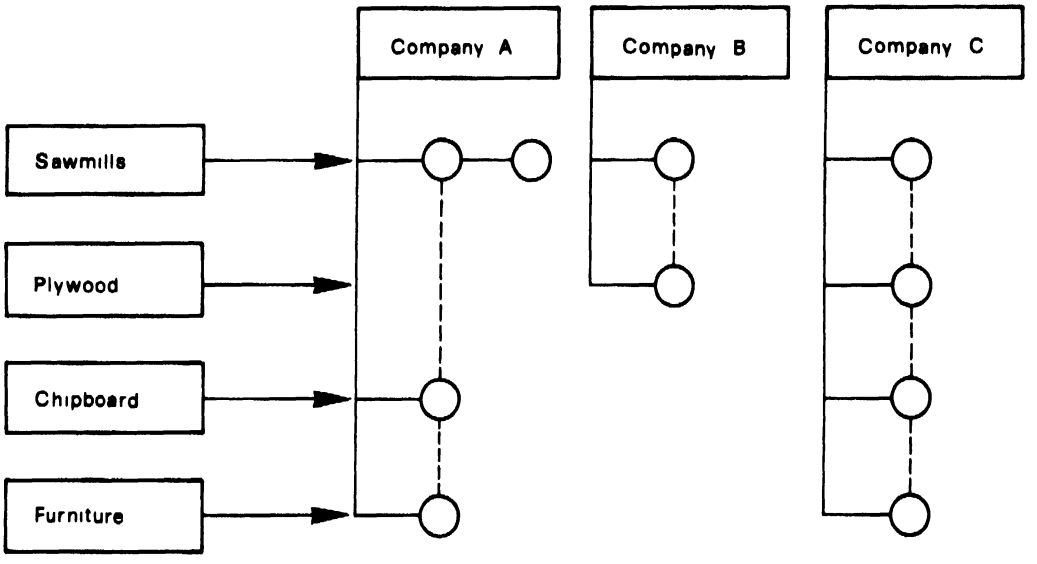
1.4 Organizing the corporations

The matter becomes more complicated when there are more organizational levels in a corporation. As an example, let us imagine that there is an enterprise which consists of the Head Office with its own responsibilities and three companies with different kinds of product lines in each company.

Company A consists of two sawmills in different places, one chipboard mill (located with one of the sawmills), and a furniture producing unit.

Company B consists of one sawmill and one plywood plant and company C has one sawmill, one plywood plant, one chipboard plant and a furniture manufacturing unit all situated in one compound.

The internal organizations of all these companies are probably different from each other because the need of management planning and control as well as the need of coordination is different. The situation can be illustrated as follows:



In company A it would be wise to keep both sawmills under the same manager in one or two profit centres and the two other production lines as separate profit centres each. It could be beneficial to organize companies B and C on a profit centre basis.

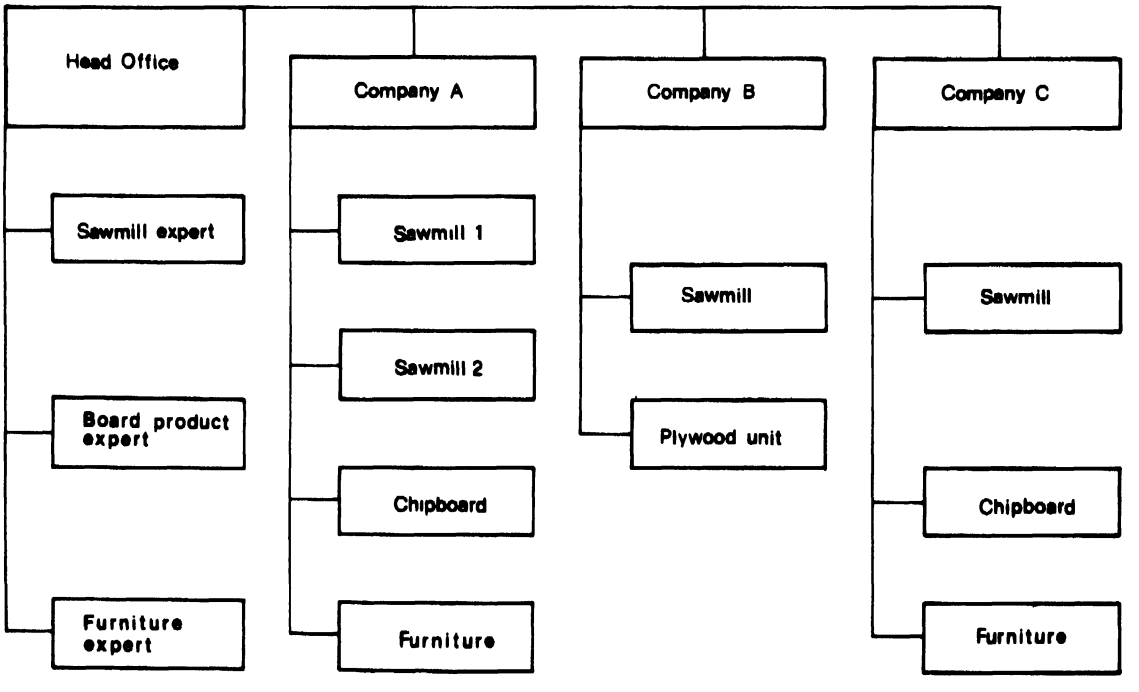
The key question is the role of the Head Office. If the only purpose of the Head Office is to be a holding company, a very limited organization is needed. In that case the main organizational units in headquarters (HQ) should be the corporate planning unit and the financial/accounting unit. A small manpower development unit would also probably be needed. In this case all the HQ units are staff organizations without any direct responsibility for the results of any business. The main way to manage the different parts of the organization in this case is by investment decision-making.

If however the HQ should have a more active role in the corporation, then the organization of the HQ will be larger and more complicated. There are at least two major decisions to be made concerning the HQ organization: What kind of staff functions are needed, and are there any line responsibilities in the Head Office? A certain part of staff functions exists in almost all organizations: financial, manpower, legal or corporate secretary, internal auditing, and so on. In one way or another corporate planning, technical assistance, as well as market surveys and so forth have to be organized.

Line duties: general advice can be given on this matter. Perhaps the most common line function at HQ level in forest industry corporations is a centralized export sales organization. Also quite often in the Head Office you will find some kind of technical department which is in charge of key spare-parts and perhaps also of the central maintenance services, especially when special skills or equipment are needed.

The most important question, however, is what kind of business coordination is needed in HQ. Basically this is a strategic question. It is dealt with in section 2. Depending on the solution the organization in the HQ is small or large. If the strategic line of the corporation is very decentralized and the operating companies have enough skilled human resources, then probably only a limited number of experts for each industry are needed in HQ. It should be noted that even if the companies are independent, some kind of coordination is needed at the corporate level, but in many cases this coordination is solved otherwise than through organizational structure. The main management tool for this is a multi-level corporate planning system with centralized investment decision-making.

If the subsidiary companies are only production units, or if there is a strong need of coordination in the corporation the Head Office's need for business-oriented resources is considerable. If this is the case, the solution is a more or less matrix situation. In one way or another two things must be solved in the HQ organization. One is to whom the subsidiary managers are to report and the other is what kind of reporting relationship there will be between the subsidiary business sector heads and the Head Office experts. The following situation has to be organized.



In this illustration, there are only three experts in Head Office (one for sawmilling, one for board products and one for furniture manufacturing or for all further processed goods).

The subsidiary managers report directly to the general manager (or managing director/president/CEO) of the corporation. Local profit centre managers report to the subsidiary manager. The most difficult question is the role of Head Office business experts. The easiest way is to keep them as technical experts only. If this is their role, they will give assistance to the subsidiary company managers when needed and keep records concerning efficiency ratios, etc.

If the duties of HQ experts nearly resemble the business development aspects, the situation comes closer to matrix organization. Often in the long run it is not good to let the subsidiary companies become too independent in investment decision-making, because they could lead the whole corporation into difficult situations by making all decisions locally. So there must be people in HQ to control and plan according to the business entity as a whole.

For instance, if company B wants to establish a chipboard unit in order to use all rejects and slabs coming from other units and, at the same time, companies A and C are planning to invest in plywood lines, because they see local markets for plywood and also need it for their furniture manufacturing, all these plans might be good as seen from the subsidiary aspect but perhaps not good or realistic for the whole corporation. If there are product group managers in HQ, they must see the situation in a larger scale and contribute to strategic decision-making. They should be experts in technical questions but they should also understand the business situation. If there is lack of high-calibre experts in the whole corporation, one organizational solution is to keep them in the HQ, give them more power in strategic decisions and let the subsidiary people run the everyday operative business independently.

1.5 Summary

Organization is one of the most important management tools in business. It must be considered as a tool and not as an end in itself. The best organizational structures are simple and clear. If there are independent business units and sufficient people to run them, it is recommended that profit centre organizations be used. Otherwise, it is best to keep the organization functional. Use matrix organization when necessary but avoid it when possible.

Organization systems are not meant to last forever. When the size of the company or business dimensions are changing it is wise to check whether the organization still meets the needs of the management.

2. STRATEGIC PLANNING IN CORPORATIONS

2.1 Strategies in a corporation

Strategy is a term adopted for business management language from the language of military operations. It means a programme of concrete operations determined on the basis of thorough analysis of the existing situation (intelligence operations) to hit the targets (defeat the enemy) of the organization (our army) at both long and short range.

Strategies are decisions of today with influence far into the future. Some studies have shown that it is common in business life that strategic decisions of the past determine an average of about 80 percent of the profitability level of the companies today. The average impact of operative solutions usually affects only 20 percent of the level of profitability. This means that the strategic decisions, at least in business organizations, are the most important decisions to be made.

In a corporation, a new strategy may often mean the concentration of the corporation's resources on some key areas and because the movement of resources is usually costly, this means an obligation to the chosen strategy for a long period.

Only a strategy which is well implemented is useful. Therefore it is very important that when a strategy is decided upon, all the people who are concerned will know the answers to the questions: what must be done, why must it be done, when must it be done, and by whom.

Because a strategy aims at the fulfilment of a corporation's basic targets, it does not mean that a new, wrong strategic decision is made to hide the first one. The strategy formulation must start from the present existing situation as such and its aim is the optimum development of the corporation, not that of the individuals.

In a corporation, strategy formulation is needed at different levels. There is a need for strategies for the whole corporation, the various business lines of the corporation and the individual companies of the corporation.

A strategy for a business line defines the role of the business in the corporation, the action for the development of the business as a whole and in various companies, including the targeted competitive position, production volumes, profitability, cash flow of the business line and allocation of resources for the implementation of the strategy.

Sometimes, corporations have strategies which are directly bound up with neither existing business lines nor existing companies. These deal with new business lines and new companies or with the development of the operational function. Actions of this kind should be handled as separate strategic projects at corporate level.

2.2 Strategic planning

Strategic planning in a corporation is a systematic approach taken to create proper strategies for the various parts of the corporation and thus it is a process which guides the management in the making of their most important decisions. Therefore successful strategic planning presumes that it is understood to be important and valuable.

There are several aspects which make today's strategic planning still more important than it used to be. The environment of the corporation has changed and will change. The economic growth in the world has changed its pattern, technological changes are faster than before, world demand for and supply of forest industry products are changing. As a result, the competition is changing and in many countries the availability and cost of raw materials and supplies have changed.

In a changing environment the corporation must be directed consciously. Usually, forest industry corporations in developing countries have developed little by little without a comprehensive corporate plan. The result is that nowadays these corporations consist of a sum of parts which are not very well balanced. Even some individual companies may be very complex totalities.

To be able to direct this kind of complex system in a changing environment, we need formal planning, which is called strategic planning in this paper.

Strategic planning is a tool for keeping the whole corporation and its parts, business lines and companies in line with developments by determining the key issues at hand and the actions needed to deal with them. The needs of various parts of the corporation are balanced with the resources available.

In many corporations strategy formulation has been and still is intuitive and is based on behavioural models which were successful in the past. In the changing environment, these kinds of strategies are seldom successful and trying harder and harder with a wrong solution only means more waste of scarce resources and unprofitable results.

The main phases of the systematic strategic planning process to be described more in detail in the following sections are as follows:

- Strategic analyses
- Formulation of alternative actions
- Balancing of strategies
- Implementation planning.

2.3 Strategic analyses

Quite often the most difficult problem in strategic planning is how to find the right questions to be answered during the planning work. Systematic analysis of the situation in which the corporation happens to be helps to find these questions.

To be able to direct your attention to the most important areas in your strategic analyses, it is reasonable to go through the following questions before starting the job:

- What is the time span necessary to make the strategic decisions? Is the near future under control or is the corporation/company in a crisis?

- If the existing strategies/lines of actions are followed, will the future be according to our basic objectives or are changes in strategies compulsory?

- What is the basic nature of our strategic position? Are we in a defensive or offensive position?

- Are our basic problems strategic at all? Are the most urgent changes needed at operational level?

- Do we have only one main problem or are we in a complex and highly problematic situation?

Your answers to these questions will guide you in selecting a suitable approach for analyses.

In the following, a general review has been made of the field of strategic analyses.

Strategic analyses have to be carried out at both corporate and company level, even if the corporate level analyses often comprise mainly summaries of the company level analyses. At both levels, the analyses deal with the unit as an entity (corporation or company) and with the business lines.

In the analyses of units as an entity the following aspects usually have to be dealt with:

- Changes in the economic, technical and social environment affecting the operations of the unit;

- Changes in the expected availability of scarce resources like skilled manpower and funds;

- Change in attitudes of shareholders (owners, government authorities, financial institutions and employees);

- Operative and financial performance of the unit and its sub-units and reasons for poor and good performances;

- Suitability of organization, manpower, management systems and physical resources of the unit to fulfil its mission;

- Functional bottlenecks in the unit most hindering its performance.

When the above-mentioned subjects are fully analysed and discussed within the unit's management, the key areas of attention (strategic problem areas) usually emerge.

The reasons behind these strategic problems often have their roots in the problems in some business lines. Therefore analyses of the business lines are very important and are dealt with here in more detail.

The analyses of strategic business lines at both corporate and company level can be divided into three main areas as shown below:

- The general attractiveness of the business area;

- The unit's existing competitiveness when compared with its main competitors;

- The possibilities of improving the competitive position of the unit.

The general attractiveness of a business line or area is usually measured using the following factors:

- The geographical distribution of demand in the potential market areas;

- The present and future levels of demand for the product in these market areas;

- The number and quality of competing suppliers;

- How well the suppliers of that product in some market areas are doing;

- The sensitivity of the demand to changes in economic activities;

- The risk of very competitive substitutes.

One of the most important factors in the evaluation of the attractiveness of a business area is the growth rate of demand. If demand is growing very rapidly, there are always plenty of new customers asking for the products. In these conditions, the price level tends to stay stable or even goes up and the general profitability is satisfactory. In the opposite situation, if the demand is decreasing because of saturated markets or because of strong competition by a substitute product, the prices tend to decrease as a result of oversupply and the average profitability is poor.

In analysing the unit's existing competitiveness, when compared with its main competitors, the following items have to be dealt with:

- The business area's strategic environment; the main factors determining the competitiveness;

- The unit's existing ability to use these factors for its own benefit;

- The competitor's ability to make use of them;

- The unit's profitability when compared with the average and best profitability in the same market areas.

The areas in which a forest industry corporation or company can usually improve its competitiveness are the following:

- Cost efficiency
- Quality of products
- Marketing
- Punctuality of deliveries.

Most of the products in forest industries belong to the so-called volume-businesses where the products are very similar (sawn timber, boards) and the basic competition factor is the price of the product.

In these businesses the cost efficiency of operations is usually the basic factor which decides which one of the suppliers is making a profit and thus able to survive in the competition.

A forest industry unit can improve its cost efficiency by using the following measures:

- Utilizing the existing production capacity fully;

- Balancing the capacities of various operative functions (logging, sawing, transport) with each other;

- Improving the productivity of all operations;

- Tightening the cost control at all levels of organization;

- Increasing the market share in certain market areas.

The scale of production is very important in volume-products. When the scale increases, for instance, in a sawmill line, the production cost per produced unit decreases for technical reasons until it reaches a certain level when it starts increasing again. Most sawmills in developing countries are still below this optimum scale of production and so they still have possibilities of increasing their cost efficiency by increasing capacity use, if the markets on which they can be competitive will allow it.

The increase in the production volume also increases the cost efficiency because of the learning effect. If a company producing prefabricated houses increases its annual production, for instance from 10 houses a year to 100 houses a year, it is most probable that the employees participating in the production have learned their work much better and work faster than their competitors still producing only 10 houses a year, thus increasing their relative cost efficiency.

Increasing market share in certain market areas increases cost efficiency by rationalizing the distribution operations. If a forest industry company is selling and delivering its products to three market areas instead of 30 areas, the cost of selling and delivering a product per produced unit is usually much less than in the latter case.

In general, it can be forecast that when concentrating their efforts on smaller areas the companies usually increase their cost efficiency by doing less but operating better. In many cases this applies also to the width of product range.

Several forest industry companies in developing countries are dealing with too many product lines thus scattering their scarce resources into too many operations. This usually results in high unit costs making the products uncompetitive when compared with specialized competitors or substitute products.

It is usually useful to collect the results of the analyses of various business lines into a business portfolio matrix as shown in Fig. 1, in which the main market areas of the business lines of the unit are placed according to their general attractiveness and relative competitiveness. The sizes of the circles in the matrix indicate the relative importance (e.g. annual turnover) of the business line in the unit.

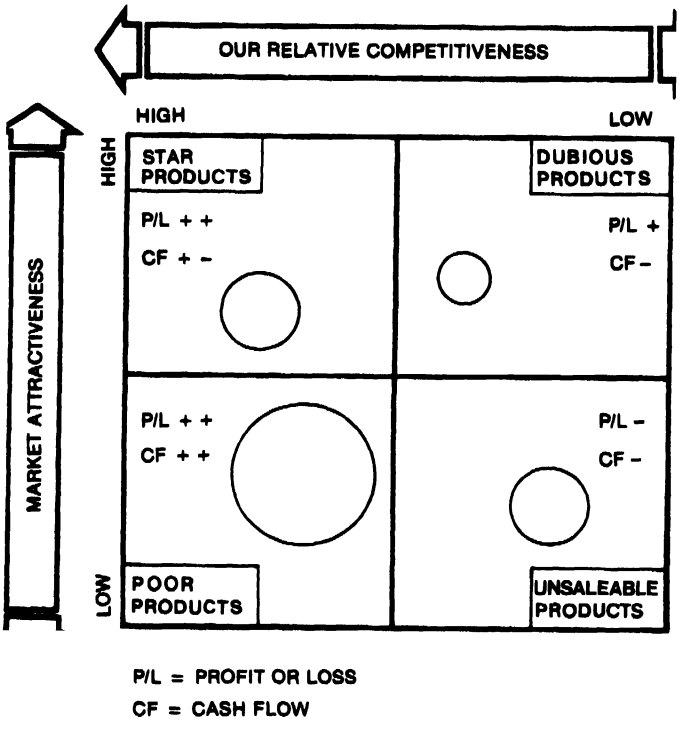


Fig. 1 BUSINESS PORTFOLIO ON A CERTAIN MARKET AREA

On the basis of this matrix, it is easy to discuss the strategic alternatives of the unit: Should it withdraw from some unattractive business areas where its competitiveness is low? Should it invest in some very attractive areas where the competitiveness is or can be made high?

In general, it can be noted that there are several ways to develop the product market mix of a company. It is always possible to think of the possibility of expanding the range of operations by going with old products into new markets or with new products into old market areas, or even with new products into new market areas. The last option is very risky because too many factors are usually unknown to the company. As discussed above, it is reasonable to think over the results of decreasing the number of the market areas of some products and even the number of products in the programme.

As a summary of both the unit and business line analyses in a forest industry corporation or a company, it is usually reasonable to carry out the so-called force field analyses in which both the internal and external driving and restraining forces of the unit will be listed and discussed within management.

2.4 Formulation of alternative actions

During the analysis phase of the strategic planning the major problem areas in a forest industry corporation and in its companies have been identified, the reasons behind them have been studied and the alternative possibilities to cope with them have been determined.

The next phase in the planning process in companies is to select the best alternative actions and this can be done properly only by analysing the results of alternative measures as such and also the summarized results of some major combinations of measures.

In analysing the alternative actions or combinations of actions both the benefits and the costs of these actions have to be dealt with.

The results of minor scale alternative actions can be analysed by using sound reasoning, but in the case of major investment alternatives at least some kind of preinvestment studies have to be produced to convince the decision-makers of the viability of the alternative.

2.5 Balancing of the strategies

On the basis of analysis of their general situation as an operating unit and the quality of their business portfolio, the companies in a forest industry corporation form alternative action plans, which they study in respect of benefits and costs.

Then the companies are able to tell the management of the corporation the programmes of action they propose to undertake and the alternative means of action they have seriously studied, both including the most probable results from actions, like future volumes of production, profitability and cash flow of the company and the amount of resources needed to implement the proposed action programmes.

When these proposals are summarized at corporation level, it will be noted that taking into consideration the overhead costs and other cash outflows of the corporation, (and the assumed inflows of funds to the corporation in the form of debt or equity) the total cash flow of the corporation is either positive or negative.

Similarly it will be noted if the planned need of skilled manpower or the need of other limiting resources is bigger or smaller than their assumed availability.

On the other hand, the corporation will find out from the summaries if other parameters like the volume of production of various products and the level of profitability will be satisfactory if all the proposed actions are implemented.

If there is any contradiction between the need and availability of resources or between the objectives and results of the corporation on the basis of proposed action programmes, as there usually is in practice, the programmes need adjustment. The management of the corporation has to balance the situation.

In a complicated multi-unit and multi-branch corporation, the analysis of corporate level alternatives usually presumes the producing of several alternative long-range budgets for the corporation. Sometimes some proposed investment projects may also be so critical to the corporation that further studies on their feasibility have to be carried out before the proposals can be accepted.

On the basis of corporate level analysis of the alternatives, action programmes proposed by the companies and also produced by management of

the corporation will be ready to be decided upon as to which is the best combination of actions in respect of the objectives.

After that the management of the corporation can tell the companies which ones can implement their actions as proposed, and which ones have to change their proposed actions, and how.

Changing the proposals of some companies may sometimes need persuasion because their managements may already be bound up with implementing them. Therefore, for the sake of good motivation, it is always wise to state the reasons for the changes fully and clearly.

When the lines for the action programmes have been clarified, the companies will be ready to finalize their strategic plans in a written form, which is always important in corporations for the sake of internal communication.

2.6 Implementation planning

As stated before, only strategies which are implemented are useful.

The implementation of strategic plans presupposes that the action programmes formulated during the planning process are so concrete and clearly defined that on the basis of these, individual implementation plans can be produced for separate actions. These plans have to be so detailed that they can act as a basis for annual planning. If not, additional work is needed for implementation planning.

For any action which is important for the implementation of the chosen strategy, a written programme must be produced. In this programme the separate phases of the action must be described, the people responsible for the implementation of the phases must be mentioned, the timetable of implementation has to be defined and the control of implementation organized.

Very clever strategies have been formulated for companies but too often, because of poor implementation, companies have failed and disappeared.

2.7 System approach

Strategic planning in a forest industry corporation is a complicated process because usually most corporations have many product lines and several producing units.

Even a small corporation may have several sawmills, a boardmill, a box factory, a door factory and similar production lines. Bigger corporations may, in addition, have pulp- and papermills, which in some cases are integrated with themselves and with other lines of production. So the mix of products and production technologies may already be quite complicated. Usually corporations also service, in addition to the local markets, customers in neighbouring countries and quite often also countries on different continents.

The complexity of the operations makes corporate decision-making difficult. Only the specialized people in each operation have the knowledge needed to make the decisions. Therefore, there is very seldom any manager in a corporation who could carry out the strategic planning on behalf of the people responsible for this kind of separate operation; the planning has to be done by the people themselves.

This planning process, however, must be well coordinated so that the overall objectives of the corporation will be achieved in the best way.

The environment of forest industry corporations changes regularly because economic, technical and political life in general is changing due to alterations in competitors' strategies. Therefore, the strategic planning process has to be carried out at least every second year. Nowadays when changes seem to be more rapid, it is common to do this planning annually.

According to our experience, the first time the process is carried out it is usually quite time-consuming and burdensome to the management of the corporation, but it always becomes easier when the process has been learned and the contents of the planning areas become familiar.

The contents of the planning process have been described previously. In this section, the sequence of various phases and the relationships between them will be discussed in more detail.

In Fig. 2 the flow of the strategic planning process in an African forest industry corporation is shown phase by phase.

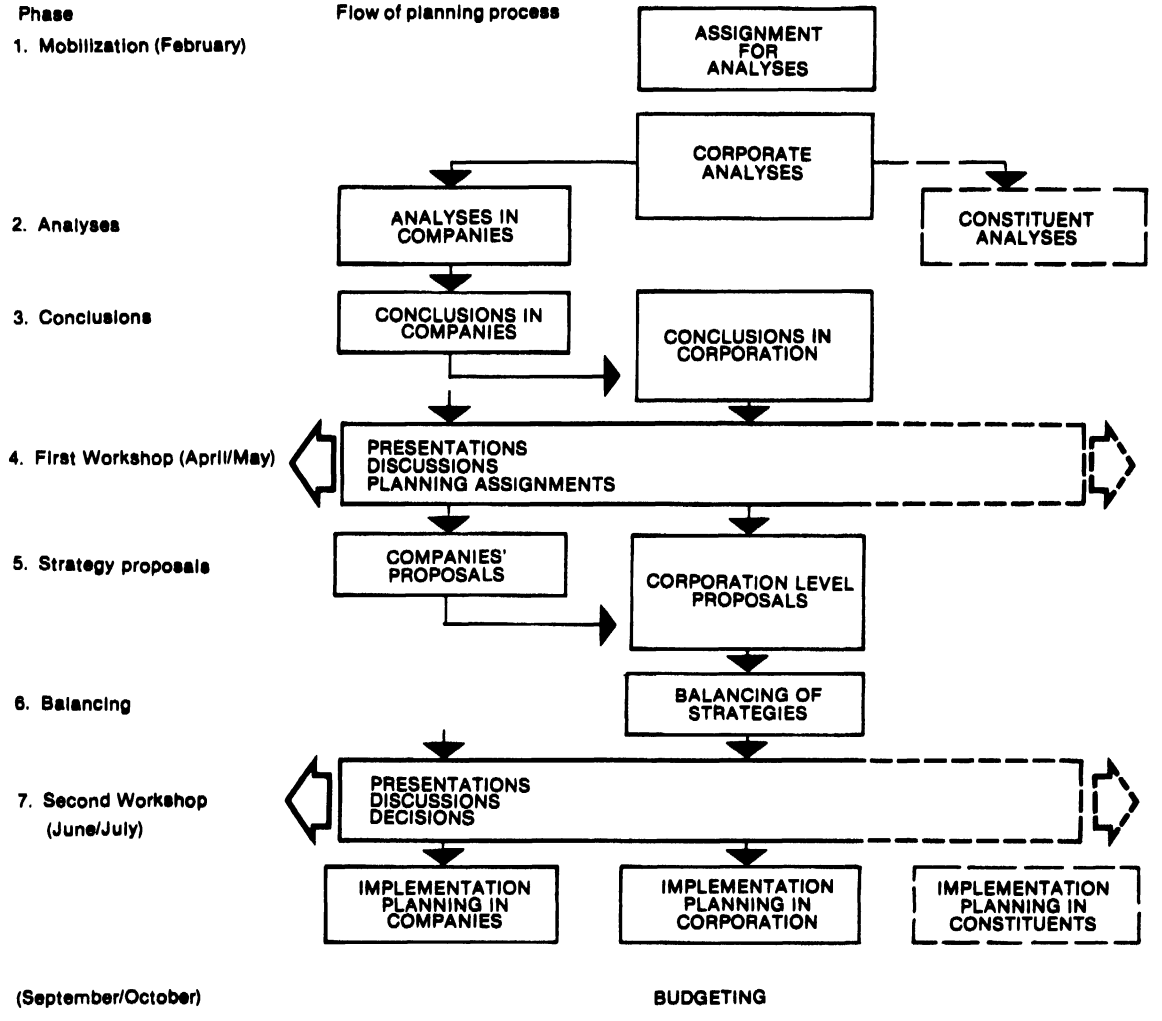


Fig. 2 STRATEGIC PLANNING PROCESS IN A FOREST INDUSTRY CORPORATION

The timetable shown in the figure is constructed so as to ensure that the process will be over well before budgeting starts in the corporation in September. The core of the process is formed by two workshops, in which the management teams of all companies of the corporation and the management of the corporation's Head Office participate.

During the workshop the results of the previous working phases will be reported and discussed and the lines of the following phases will be described.

In the following, various parts of the strategic planning process in a corporation that is starting up will be discussed in more detail.

Mobilization

Mobilization is the starting point of the planning process. Its aim is to give all the participants clear pictures of the following aspects:

- Targets of the planning process including tentative key-issues for the planning process;
- Schedule of the various phases including dates of workshops;
- Agenda and forms to be used in the two first planning phases (analysis and conclusions) and the deadline, when the results must be in the Head Office of the corporation (two or three weeks before the first strategic planning workshop);
- Demand and supply forecasts for the main products of the corporation in its main markets.

The mobilization in the Head Office has to be done before assignments are given to the companies. In this way, some basic analyses of the past performance of the corporation and individual companies can be carried out beforehand and the results of these analyses can be included in the assignment information.

The strategic planning process can be mobilized by sending assignment letters to the companies but better results will be attained if members of the Head Office's management visit the companies and explain the targets and tasks to the management personally.

Analyses

The analyses in the corporation have to be started by studying the former performance of the whole corporation by collecting data from the past three to five years:

- Summaries of the production of various products in volumes by companies;
- Summaries of the sales of various products by companies;
- Summaries by products of domestic and export markets and the corporation's market shares by main market areas;
- Summaries of the sales and net profits of the companies.

During the first planning exercise, all the information from previous years and various companies will not be available in the Head Office of the corporation and will have to be collected from the companies as a part of their own analyses.

The starting point for the analyses in the companies will be the comparison between their planned and achieved results and the analysis of the reasons for the differences. In doing so, the following data will be collected:

- Operational results of the last year including operations such as:

  . logging
  . production of various products
  . purchases of the main materials
  . sales
  . hiring of manpower
  . organizing, financing, etc.

- Analyses of the reasons for differences between the planned and achieved results by operations;

- The attractiveness of the business areas of the company measured mainly by demand expectations and competition situation;

- The company's relative competitiveness in various business areas;

- Analyses of general key parameters most affecting the company's ability to perform.

The Head Office of the corporation must analyse its own operations in the same style. These operations are mainly functions supporting the companies.

The purpose of the constituent analyses is to get a good picture of the objectives, priorities or limitations set for the corporation by its constituents and the best estimates about the material and human resources available for its use in the future.

As a minimum, the following subjects must be clarified:

- Availability and costs of key materials such as logs, fuel and import licences for spare parts, if these items are regulated by authorities;

- Future allocation of key production resources such as local and foreign exchange and skilled and semi-skilled manpower;

- National expectations like production and sales targets set for the corporation (if any), the corporation's freedom to determine and develop its business areas and the corporation's profitability targets.

Conclusions

After analysing their last year's performance and future projections, the companies must come to conclusions about the following aspects:

- Which are the most important strategic themes/problem areas for them? And where can they find positive solutions?

- What kind of alternative actions can they, or the corporation, perform to improve the situation?

- What are the benefits and costs of each alternative action when compared with the other actions? And what is the order of priority of the actions?

- What is the summarized need of additional resources (money for investment and skilled manpower)? What are the annual costs if the actions selected by the company are implemented? And what are the total benefits attained by the implementation?

The Head Office of the corporation will carry out a similar kind of concluding process dealing with its own operations (operations supporting the companies).

After receiving the conclusions from the companies, the Head Office must reach conclusions on the actions requested of them by the companies and must summarize the needs for resources, costs and benefits of the actions originally proposed by the companies and the Head Office.

First workshop

In this workshop, the companies and the Head Office will present the findings of their analyses and the results of their concluding process.

After every presentation a short discussion will be necessary, but the main discussion should be held after all presentations have been made. In this discussion, minor items should be avoided and the most important subjects should take up most of the time available.

As a result of this workshop all the participants must have a clear picture of the following subjects:

- What are the main problems of the corporation;
- Which are the best ways for the corporation and its companies to solve these problems;
- What the corporation's main strategies/lines of action will be during the coming years;
- What kind of planning assignments the companies and Head Office have for the preparation of their tentative strategic plan.

Strategic proposals

The companies have to summarize their strategy proposals in the form of a proposed strategic plan. The main objectives have to be those of most importance to the company, and the actions have to be concrete so that later on it can be determined who should do what and when.

The Head Office has to plan its strategic operations including projects and the supporting services it gives to the companies.

After receiving the companies' plans, but before producing a plan for the whole corporation, the Head Office has to produce a supply and demand forecast for the most important products. This forecast includes an analysis of the relative cost competitiveness of various competitors and this has to be carried out at least with the products in danger of oversupply.

The Head Office produces a proposed strategic plan for the whole corporation by summarizing the plans of the companies and its own.

Balancing

When the Head Office produces the strategic plan for the corporation, differences between resources needs (funds and skilled manpower) and availability may appear. This will mean that all the proposed actions cannot be implemented according to the proposed schedules.

In this situation it is the role of the Head Office to decide by analysis which actions are the most important for the whole corporation and which ones can be postponed or abandoned.

On the basis of these analyses, some preliminary replanning has to be carried out in the Head Office so that a balanced situation can be achieved in the corporation.

Second workshop

The proposed strategic plans will be presented and discussed in the second strategic workshop. During this workshop the final balancing will be made between production needs and plans, and resources needed and those available.

All decisions needed for the finalization of the strategic plan have to be made during the workshop or immediately after in order to produce the final plans well before the budgeting work starts in the corporation.

Implementation planning

After the strategic plans of various units have been finalized, a detailed planning of the implementation has to be carried out in order to cover the gap between the strategic plans and the annual budgeting.

It is very important that everyone's work is clearly indicated in writing: who will do what, and when. For certain complicated operations an implementation schedule must be produced.

The designing of a strategic planning process for a forest industry corporation in developing countries is usually not an easy task because of difficult communications which limit the reasonable number of important workshops and because of scarcity of experienced management resources.

Therefore it is advisable to start with an uncomplicated system and to develop it later on when understanding of the process and its contents has increased.

The installation of a strategic planning system in a complicated corporation, without previous experience of comprehensive strategic planning, is usually speeded up with some outside help from people or organizations with previous experience in strategic planning in similar conditions, and this is included in the process.

2.8 Strategic planning in corporations

As noted before, strategic planning is one of the most important tasks of the corporation's management and this fully applies also to forest industry corporations in developing countries.

In some cases, the purely operative problems of the corporations may be so overwhelming that the management's ability to allocate time for strategic thinking is limited. But even so, it is better, through long-range planning, to guarantee that whatever the corporation is trying to do in its problematic surroundings is correct.

It is not useful to try harder to do the wrong things.

At the corporate level, trying to do the right things usually means balanced and controlled development of the operations which in turn are optimal each time in respect of the constituents of the corporation and the corporation itself.

3. ORGANIZATION DEVELOPMENT

3.1 Needs for development

The basic reason for improving the organization normally arises from the preparation of a strategic plan. Generally, changes in strategies mean a need for changes in the organization. The slogan: "From strategy to structure" is true in most cases.

The management of any company, including a company operating in the forest industry sector, is a multidimensional task. As described in the previous section, strategic decision-making is the fundamental basis for all other management actions. It can also be proved that a strategic plan without clear implementation phases is useless. One of the most important implementation tools is the development of organization.

Depending on the key issues in the strategic exercise, the subjects of organization development are different from each other. If, for instance, the key problem in a strategy is low-cost competitiveness, the major job in the organization will be the improvement of efficiency and effectiveness throughout the organization. If the main outcome in a strategy is expansion in the market, the main duty on the organizational side is to strengthen the sales force and probably to improve and develop new marketing methods. If competing products are substituting for our products, the key action to be organized is product development.

In addition to strategic reasons there may be other forces which lead the company to improve its organization. For instance, the organizational structure is found to be old-fashioned or too complicated vis-à-vis the challenge it has to meet. Sometimes small, independent profit centres are more effective than large, centralized functional organizations.

Another reason for improving the organization might be poor performance in everyday actions. Strategically everything may be in order in the organization, but the reason for organization development comes from the operative side. One further reason can be the wrong distribution of human resources inside the company, that is, the number of people may be correct but they are in wrong places within the company.

3.2 The subjects of organization development

In many cases it is believed that improvement of the organization means only changing its structure. Quite often one of the subjects to be improved is, in fact, the structure. As described earlier there are basically three main structures: functional, profit centre and matrix structures.

If it is found that the organization does not work well, one of the things to be checked is whether the wrong solution has been applied to one of the basic problems. For instance, a functional main structure may concentrate too much effort on the improvement of separate functions or may overemphasize one function instead of getting a balanced improvement of the whole. Or, because of some kind of matrix situation, there is an overall confusion about the duties and responsibilities of people in management. This kind of situation seems to be quite common especially in large corporations which have heavy organization in their head offices and operating companies.

In many cases the structure itself is quite clear, and still there is something wrong in the organization. One reason for this may be indefinite job descriptions. People in the organization do not know what their main duties and responsibilities are. Normally, it is not enough just to draw an organizational chart and put names in the "boxes". Very seldom is the picture so simple that people can run their part of the

business using only this information about their duties and mutual relations. If the key areas and the limits of an organizational post are not described in written form, people normally concentrate only on the interesting parts of the total field or on the areas they know best. A rule of thumb is that the more complicated and multilevelled an organization you have, the more time and emphasis must be given to clarification of the key element of each post in the organization structure.

One subject for the improvement of organizations may be the distribution of human resources among the different posts, i.e. the manning of the organization. There are two subquestions inside this subject. One is the manning of key management posts and the other is the decision on how many operative people are needed in each function. Finding good, high-calibre managers to man the key posts is the most crucial issue in any organization, but it is extremely difficult in the developing countries where the forest industry is new. The lack of experienced management is probably one reason for using functional organizations. As said earlier, in this solution you need only one person with good knowledge of general management. The rest of the key management can concentrate on their own functions and train themselves mainly in this narrow field.

If the basic organization structure is of the profit centre type, there is a need for people who have a general understanding of management for every profit centre. Managing a profit centre means that the head of that organization has to understand his business strategically and also be familiar with manufacturing, sales, accounting, and, last but not least, have leadership talents for leading his organization.

The most difficult situation for top management is when the basic strategy must be changed. If the outside environment has changed, it means that the old strategies no longer work. The question for superiors, board or general, is: Should we still rely on the old company or profit centre manager and has he enough flexibility to change himself and his business or should he be replaced? Normally, the old management goes on in the case of strategic changes, but it must be understood that sometimes it is necessary to replace people as a consequence of an organization development task.

The other question in manning the organization is the quality of people needed in each function. The necessary number of personnel needed is not easy to determine. For instance, the degree of automation in manufacturing or management accounting greatly affects the need for personnel. International ratios or other rules concerning how many people constitute the right number do not work because the environment, the national habits and customs vary. But still the basic rule is that if management is not concerned about the number of people in the organization, there will be too many of them.

So far the matter under consideration has focused on the structure, job descriptions and manning of the organization as a part of organizational development. There are, however, still more subjects to be covered. One is the way of working, or working methods. Very often it is easy to see that old routines are disadvantageous for effective working. Nobody has stopped to think how even very simple everyday routines should be changed in order to get more efficiency.

Changing some small routines may be easy but improvement in methods normally means real studies on the right ways and even time scheduled programmes to get them through. Just an example: If the marketing situation has changed, it is not easy for salesmen to understand that they have to change their ways of selling - even dramatically. While earlier it was enough to sit in the office and collect the orders, they

now have to formulate customer groups and visit them regularly. This kind of major change in organizational behaviour really means planning and the implementation of new working methods.

One very important subject which quite often needs improvement in the organization is motivation. Although the word motivation means different things to different people, it is of the utmost importance to maintain and develop it in organizations. In practice we have to combine several organizational development areas in order to get more motivated people for our organization.

3.3 Tools for organization development

As described in the previous section, there are very many things which may be subject to improvement in an organization. Management needs tools for this kind of development. The first one is the organization study. This kind of study means creation of the overall picture of the organization. The basic idea of the study is to compare the existing structure and performance of the organization with the needs it has to fulfil. Subjects of this study are those which were mentioned previously, i.e. structure, clearness of responsibilities, quality and quantity of personnel, working methods, and motivation. If possible, it would be preferable to give this kind of study to an outside management consultant because an outsider usually sees the situation more clearly than people within the organization.

When the objects of improvement are found, larger or sometimes more detailed programmes are necessary. The changes in the structure will not be further discussed here. Other subjects may be improvement of job descriptions, formulation of company policy manuals, planning and implementing some kind of management by objectives programme, improvement of management accounting practices, formulation of training programmes or job rotation plans, and improvement of incentive systems.

The list above is not complete but it shows how diversified an organization development exercise can be. A few explanations concerning some of the improvement areas may be necessary.

Job descriptions must be short and concentrate on the main responsibilities instead of long duty lists. Firstly, it is not possible to formulate a complete list of duties and, secondly, it is more relevant to describe the key responsibilities which affect success in each job.

Company policy manuals mean that there should be clear written policies for the major management activities, e.g. rules for management meetings, manuals for budgeting and investment proposal procedures, written salary and wage policies, clear marketing practices.

Management by objectives is basically a style of management. It means that the superior and subordinate are able to find such mutual targets or objectives for the subordinate that they are acceptable to both parties. This kind of annual exercise is a good tool to keep everybody's attention focused on the most critical business factors so that managers at all levels remember what is important in their jobs.

A well organized management accounting system is one of the most important management tools. If people in the organization know the economic results of their actions, they are better prepared and motivated to act properly. Management accounting is described in greater detail in the paper entitled: Operative planning and control.

OPERATIVE PLANNING AND CONTROL

by

Olavi Karttunen, Vesa Viitamäki and Hans Södergård
Oy Mec-Rastor Ab

1. INTRODUCTION

1.1 The role of operative planning and control

To manage a company one must use a great variety of management tools. These systems, approaches and policies interact with each other and it is dangerous to omit any of the major parts. Operative planning and control have at least two main linkages with other management systems, as illustrated in Fig. 1.

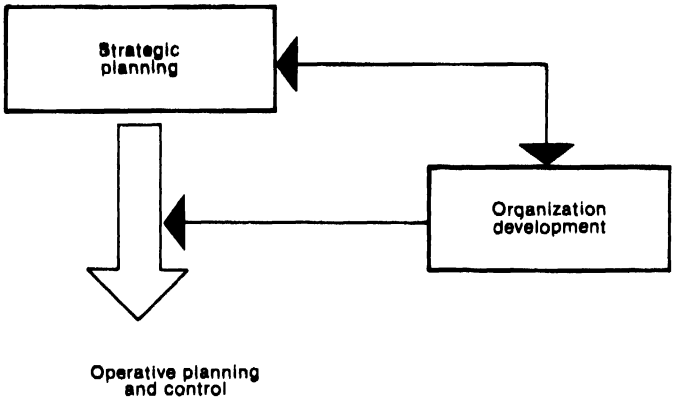


Fig. 1 LINKAGE BETWEEN MANAGEMENT SYSTEMS

Operative planning and control are the main implementation tools for strategies. The linkage between strategic and operative planning means that there must be clear and concrete strategies to be used as a foundation for planning the operations. Interaction between organizational and operative planning means that the structure of the organization as well as the responsibilities within it must be clear and well understood before operative planning is undertaken.

If any of these key parts is missing or the performance is poor, there will be troubles in managing the company. When the operative planning process starts, every participant must understand the main routes (strategies) which he has to follow as well as his role and responsibilities in the management team (organization). Of course, there must also be a clear system for operative planning. Only if all three of these subsystems are in at least a moderate condition can the management expect good results from planning.

1.2 Planning and control in a multi-industry company

Probably the majority of forest industry companies are so constructed that they operate as a collection of several units. For instance, a company consisting of a sawmill with an integrated plywood factory or a chipboard line is quite typical because the use of the raw material is more effective in this way than in separate production units.

It is presumed in this section that operative planning and control take place in a corporation which consists of many production companies, each of which operates in a multiproduction situation. In addition to the companies, there is a head office which coordinates and monitors them. It can be assumed that the corporation is the same as the one described in section 1.4.

So far the words "planning" and "control" have both been used in this section. The planning side will be described in greater detail here. Planning without control is useless. Control is a very important part of management in general as well as in the operational sphere. The reason why it has been somewhat put aside in this exercise is that control should cover the same subjects as planning. If we go through the planning exercise, it is quite easy also to draw conclusions on control. However, there are some areas in operative planning and control where the two parts are not equal. In a corporation, the head office usually concentrates its role on control and coordination, even though the plans are made in the operative units. Thus questions of control such as summaries and comparing ratios are mainly discussed separately at the corporation level.

1.3 The main parts of operative planning and control

Too often operative planning is considered as equivalent to budgeting. It is true that budgeting is an important part of it, but it is a larger concept than budgeting.

In this manual, operative planning should be taken to mean short-term or annual planning. There are two major parts to this: planning of actions and planning of the financial consequences of those actions. Only the latter is called budgeting. Before this stage, something important must be done, that is, those actions which are necessary in different parts of the company must be planned in order to attain the objectives set for the coming period of a year or less.

Fig. 2 shows the major elements in operative planning and control. Firstly, it is necessary to have a good strategic basis for short-term planning. Some of the required actions arise from strategic plans, but there are also other objectives. Secondly, as explained earlier, a clear organization is necessary in order to achieve the objectives. Only after these have been established can operative planning start, first with planning the performance of operations and then the financial side of those operations. As early as the planning stage, and especially in the collection of basic information, a chart of accounts and cost centres is necessary. The last function of operative planning and control is to report the results in quantitative and financial terms to those who are responsible.

In the following sections, more detailed descriptions are given of the various functions mentioned above.

1.4 Planning and control of actions

As mentioned earlier, the fictitious forest industry corporation used in our example consists of many companies, each having several production lines. Even though the example becomes quite complicated, this pattern is chosen because in real life this is quite often the situation.

In the planning of operations there are, and should be, two major stages. In this paper, the first is called "preliminary balancing" and the second "planning of actions".

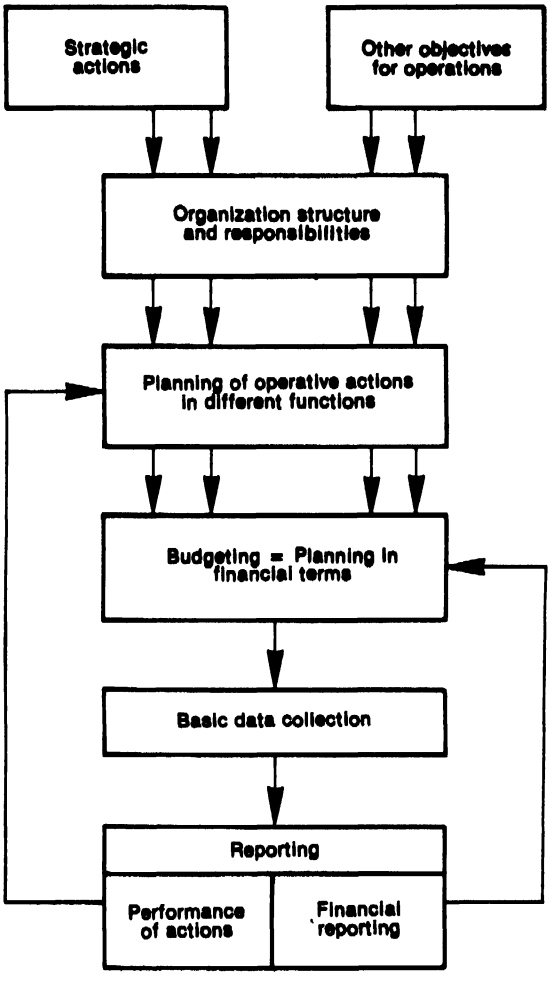


Fig. 2 MAJOR ELEMENTS IN OPERATIVE PLANNING AND CONTROL

1.4.1 Preliminary balancing

Because it is important to plan actions before calculating financial figures, it is also important to check the basic balance between the needs of markets and the possibilities of the company before starting on detailed functional planning.

The main task in this first stage is to create a picture in which the demand expectations, production capacities and possibilities for the supply of raw material are all taken into consideration in order to get a realistic idea of next year's sales and production. Only by balancing needs and possibilities at the earliest stage can the detailed plans remain sound. Without such balancing, if the basic assumptions are unfounded a large amount of work will be done in vain.

The first example of this kind of balancing is an easy one. Let us assume that there is a separate sawmill which should start to plan its activities for the next year. Preliminary balancing for this situation is shown in Fig. 3.

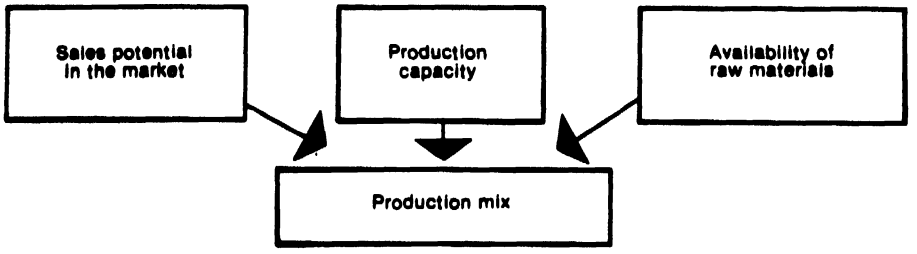


Fig. 3 PRELIMINARY BALANCING

In this case, balancing means that the sales manager must have information about the sales possibilities of different kinds of sawn timber. The production manager must have information about the real production capacity or degree of utilization and the logging manager must know the volume of logs he is able to cut and transport to the mill. When this basic information is changed into comparable units, which in this instance has been taken to be cubic metres, the result might look as shown in Fig. 4.

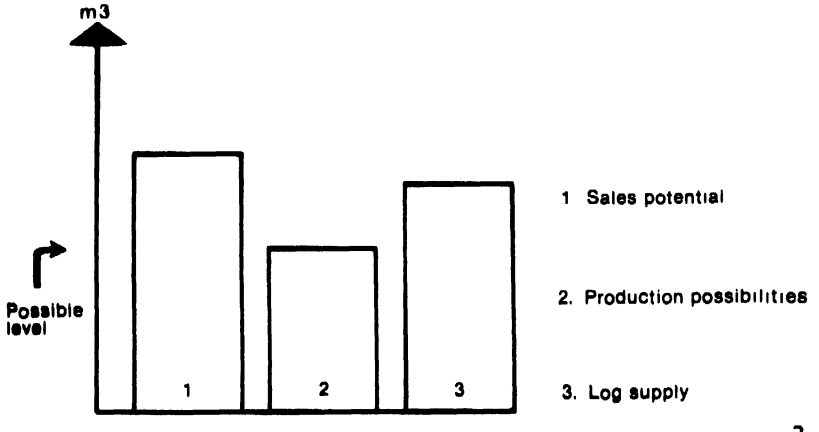


Fig. 4 ELEMENTS IN BALANCING CONVERTED INTO M^3

Examination of the figure shows that production is the bottleneck. If a company cannot expand its production, there is no sense in the sales force and logging department's planning for higher volumes. To make this example a little more complicated - and at the same time more realistic - we must recognize that the production mix has a powerful effect on the results, both in volumes and, especially, in profits. In preliminary balancing this company should know the unit prices of different kinds of sawn timber and, if the total sawing capacity is the bottleneck, it should try to select a production mix which gives the best total contribution margin for those cubic metres which can be sawn.

In a company consisting of many production units, say, two sawmills and a plywood factory, the main balancing task is to find the correct distribution of logs for all production units, especially if the raw material supply happens to be the bottleneck.

The basic balancing situation is still more complicated in an integrated company consisting of a sawmill, a plywood factory, a chipboard factory and a door plant. In this example, there are many things to be balanced: raw material distribution among the various production units, supply of slabs and rejects from the sawmill and plywood line to the chipboard factory, distribution of finished goods from all production lines to the outside market and to the door plant.

If there is a decentralized domestic marketing function run by the companies themselves and a centralized export marketing organization then again there is need for preliminary balancing between the marketing and production functions before detailed operational planning can take place.

In general, it is essential that before separate functions can be planned, the preliminary balancing must have been done. Every organization must consider the correlations of its various parts and understand what kind of balancing is necessary.

1.4.2 Planning of actions

In this kind of general description of operative planning in the forest industry sector, it is not possible to go into the details of every function. However, some basic ideas and hints may be worth listing:

(i) Logging activities

The management of logging operations should as a minimum plan their activities on the following matters:

- Logging area or compartment allocation preferably for more than a year;
- Use of own crew/private contractor policy;
- Felling and transportation programmes for each compartment;
- Resource plans and efficiency targets for cutting, skidding and transportation;
- Stock and delivery plans for different species for different mills.

Once more it must be stated that logging management must first obtain a realistic picture of the log requirements and supply possibilities. The result of this phase is mutual agreement on how to use log resources. The second phase is to plan the different activities and resources needed.

In logging as in all other activities, the basic idea is to concentrate on the key points of the activity. Before planning it is wise to stop and think of what it is relevant to plan and if this kind of activity must be managed.

(ii) Sawmilling

Again, the basic concept is: first the preliminary balancing in terms of volume, so that management knows the level of production which is regarded as being mutually accepted; then a study of the factors and selection of those to be the subject of planning. The third phase is to plan and programme key activities. The following list might help sawmill managers find the subjects of planning:

- Plan of log allocation divided by different species and time periods (months, quarters, etc.);
- Recovery rate targets and related actions;
- Degree of utilization targets and actions to reach them;

- Productivity targets (m^3/h) and actions;

- Dimensional distribution of finished products according to quality groups, if possible;

- Need of resources for different resource groups.

It is not possible to supply a set of forms in this kind of manual, but there is good reason for emphasizing the advisability of management's concentrating their planning efforts on critical issues and keeping the forms simple.

(iii) Plywood production

The plywood manager must find the key actions to be planned. They are fortunately quite obvious:

- Log consumption plan;

- Production targets and programmes for all main sub-functions (peeling, pressing, finishing), divided into suitable time periods;

- Plan for thickness distribution;

- Resource plan for each resource group.

(iv) Board product manufacturing

In broad terms the planning of production activities is similar for all board products: chipboard, hardboard and particle board. The following are necessary for production planning:

- To make sure of the supply of raw materials (wood in different shapes, chemicals, glues, etc.);

- To plan the total production and the thickness distribution for a year;

- To reserve human and material resources for the planned production.

(v) Production of further processed products

The variety of products which can be further manufactured from the products of basic chemical and mechanical wood industries is very large. The use of pulp and paper is not included in this paper, because they have been considered as basic products. Here, further processed products mean the products of the mechanical wood industry, for instance, joinery items, doors, packaging boxes and cases, impregnated poles, furniture and prefabricated houses.

Planning of production in terms of volume differs greatly from product to product. Some, such as some joinery items or impregnated products, may be similar to plywood or sawn timber if production is in bulk.

In many cases, however, production is customer-oriented, meaning that the production of many products is based on specific orders from one or more clients. This is almost always the case with prefabricated houses and also quite often with packing boxes and even with furniture.

When orders greatly affect the production, planning of the latter is different from bulk manufacturing where production is more independent of custom type sales. In order-oriented production preliminary balancing is not as important as in the bulk type. Here, the most important task is to keep sales and manufacturing possibilities in harmony. For instance, in joinery products it may be crucial to plan the use of machinery hours so that all products which require the same machinery groups can be passed through the production process. Fig. 5 illustrates the situation.

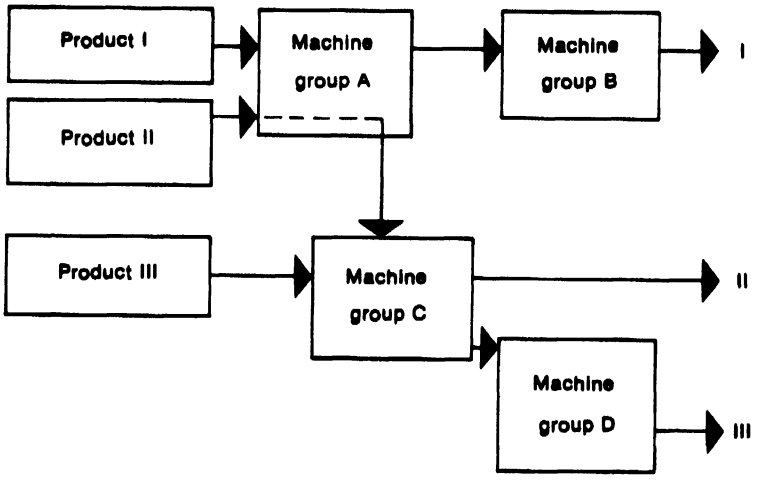


Fig. 5 PLANNING THE PRODUCTION PROCESS

The capacity of machine group A is needed for both products I and II and similarly machine group C is needed for products II and III. In this case, planning of production activities means that the balanced use of critical machine groups is one of the most important planning tasks.

(vi) Sales and marketing

In this function, as in the others, the first task is to find a realistic level of sales by preliminary balancing. If there is a centralized marketing function for exports then the balance must be found between domestic sales and exports, on the basis of volume.

Operative planning for sales and marketing must cover at least the following subjects:

- Product mix and volumes of key products;
- Customer grouping and sales programmes for each major group;
- Plan for sales promotion tools, e.g. advertising plans, exhibition schedules;
- Sales resources.

In some business circumstances, the demand for forest products is higher than production capacity, at least in some products. If this is the case, the role of sales planning is different from the situation in a competitive environment.

Here the main role of sales planning is to keep the distribution flowing. This means that the sales yards or other distribution centres must have a variety of products which best meet the requirements of clients.

(vii) Maintenance

The planning of actions in maintenance before budgeting is mainly planning for preventive maintenance. All production units should have a scheduled maintenance plan for all critical parts of the machinery and vehicles. This programme should also consist of a reserve of maintenance resources and an inventory plan for critical spare parts.

(viii) Administration

In administration, the planning of actions is needed mainly in manpower management. People responsible for this area should build up a training programme and probably also programmes for social life, etc.

Otherwise, the plans of action, when they are development plans, are mainly needed in administration. For instance, improvement of the management's accounting system really needs planning before action.

1.4.3 Controlling of actions

As mentioned earlier the main emphasis in this manual is on planning. Nevertheless, some remarks on the control side of operations are necessary.

The basic ideas in controlling are as follows:

- To follow the items you have planned;
- To concentrate on key figures (issues) instead of a large amount of detailed information;
- To transform the data quickly into reports;
- To produce different kinds of reports for different purposes, that is, be hierarchical.

Concentration on key figures means that the same absolute figures or ratios, which we found to be the most relevant ones in planning and are used to describe the success and solid performance of an area of responsibility, are also used in reporting. In practice it is recommended that graphic forms be used as widely as possible instead of large forms full of numbers.

Consequently, the reporting should be hierarchical. The key figures and ratios should be at the top of performance reports and, if detailed information is necessary, all figures should be in appendixes.

Reports of operating units should be different from those prepared in the head office. In these units, reporting should concentrate on describing how well each function has succeeded under operating conditions. This means producing reports which consist of actual figures, deviations from plans and comparisons with previous periods. In head office the role of reporting the results of actions is to produce comparisons between different units in the same action line, e.g. to follow the progress of different sawmills.

Last but not least, it must be remarked that reporting has no inherent value, but it must serve management in decision-making. On this follows the request that reporting must be analytical.

1.5 Financial planning and control

(a) Financial planning and budgeting

Planning the economic and financial results of actions is the second major part of operative planning and in the same sequence in reporting. The purpose of budgeting is the financial integration of operations geared to profitability and generating cash flow. Sound budgeting requires a clear organizational structure, comprehensive planning of operations and well managed budgeting and accounting systems.

(b) General framework

Financial planning (and control) can basically be divided into two main parts:

- Financial accounting system
- Management accounting system

The purpose of a financial accounting system is to collect and produce information mainly for official use in the corporation, and companies, if they are jurisdictionally independent. Usually only a summary type of information is needed for official purposes. The main users of this information, the parts of which are the balance sheet and profit and loss statement, are tax authorities, auditors, financial institutions and government agencies. Naturally, information obtained from financial accounting is also of interest to the management itself.

In most countries, financial accounting is regulated by the authorities and therefore it is not necessary to handle it in depth in this part. Another reason for leaving it aside is the fact that good understanding of financial accounting is necessary for a limited number of accounting professionals (although the management of the corporation and companies must know how to use this information and it must be understood when financial accounting and management accounting linkages are discussed.)

Management accounting is normally more flexible than financial accounting. Its purpose is to collect and produce information for management's own purpose. There are two main aspects of this accounting:

- Profit and cost centre
- Product profitability

The first one serves management by keeping them informed of the effect of the organization on profitability. This accounting follows the areas of responsibility and indicates the revenues yielded and the costs incurred by each cost centre. Profit and cost centre accounting is suitable for both functional and profit centre organizations. In a matrix organization its use is more difficult, because in this case the same revenues and costs must sometimes be divided between two or even more organizational units if they are in a matrix situation with each other.

In product profitability accounting the concern is not which unit incurred the costs or who earned the revenues, but the profitability of products or product groups.

The difference between these two management accounting lines is illustrated in Fig. 6.

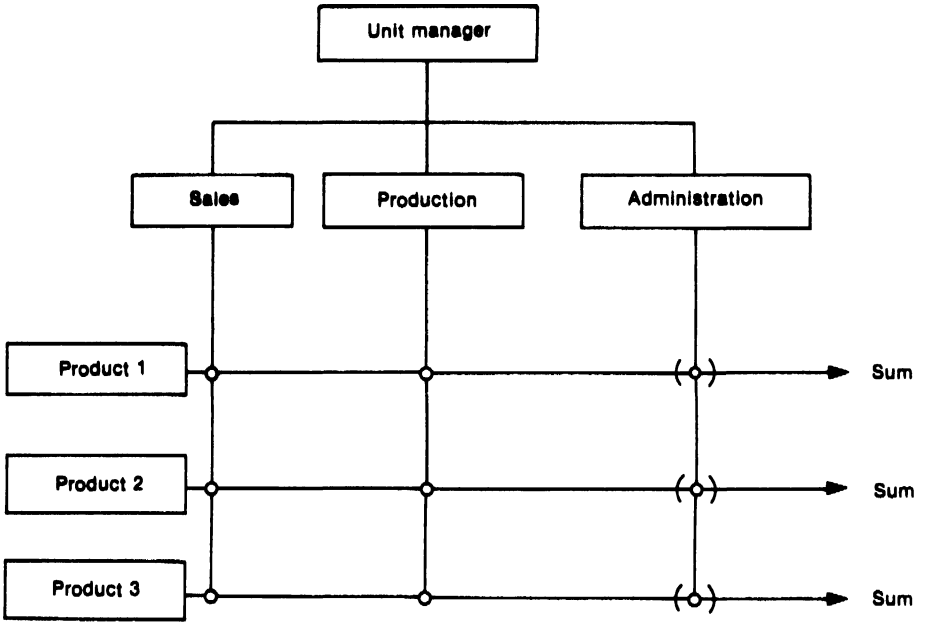


Fig. 6 A SIMPLIFIED EXAMPLE OF ACCOUNTING LINES

Profit and cost centre accounting follows the revenues of the whole unit (from sales), and the costs of each function, and the difference is the total profitability of that unit.

In product profitability accounting, if a unit produces only one product, the two parts of management accounting (revenues and costs) are balanced. Normally, however, there is more than one product going through the production line and the same sales or distribution channels. The basic question in product profitability accounting is how to divide the costs of an organization unit among the products. Fundamentally there are two basic solutions. The first is to divide all costs, even those of administration, equally among the products under the assumption that there are no better methods. The other is to direct costs only to the products with which they have a clear correlation, and the overhead costs are then subtracted from the contribution margin of all products. Both solutions have their pros and cons, but in continuous and regular accounting the second one is recommended. However, from time to time (twice a year), the first type of analysis should be made just to ensure that all costs can be covered by income.

(c) Linkage between financial and management accounting

The basic difference between these two systems is the need for details in management acccounting. In financial accounting this need is limited. Normally a company can be treated as an undivided entity and the number of accounts is small compared with those needed in management accounting.

Although their needs are different, however, good coordination between the two should be achieved. If a computerized accounting system is available, the problem is small but in the manual one there are difficulties.

In general, it is recommended that the interaction between financial and management accounting be arranged according to Fig. 7.

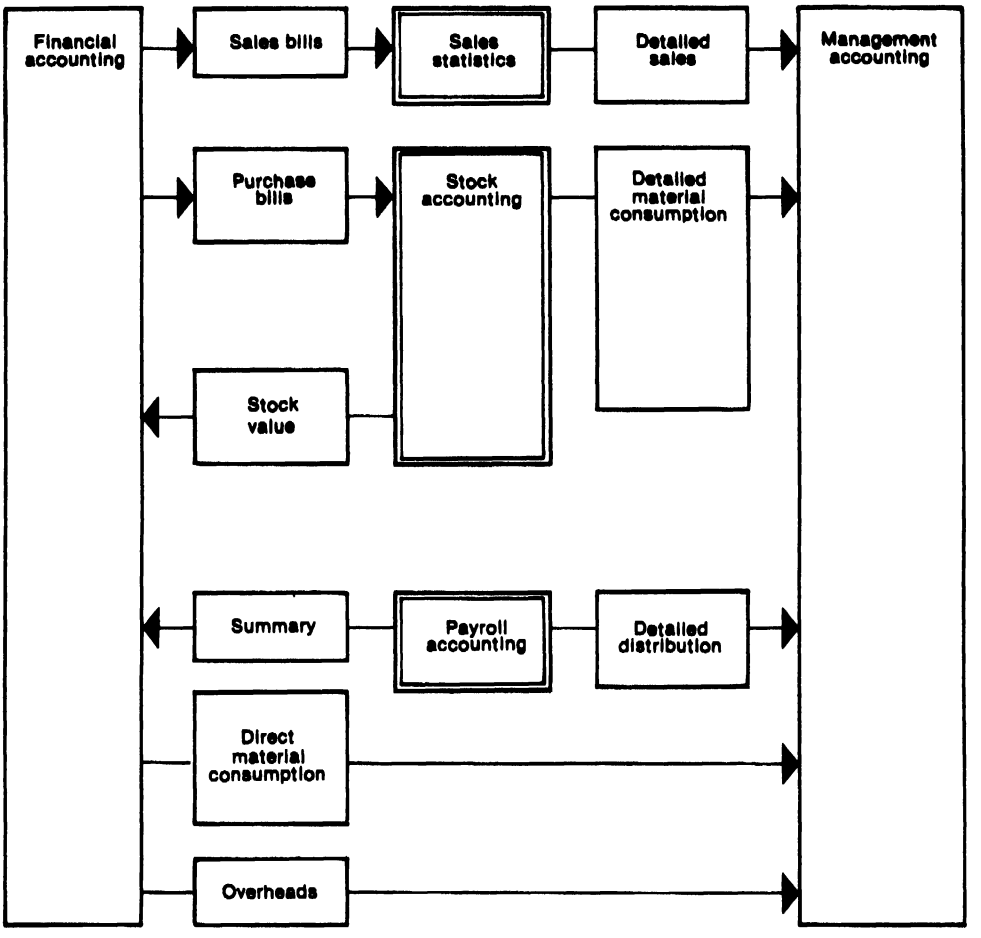


Fig. 7 INTERACTION BETWEEN FINANCIAL AND MANAGEMENT ACCOUNTING

This approach involves three auxiliary systems:

- Sales statistics
- Stock accounting
- Payroll accounting

which link financial and management accounting. Because most vouchers normally come from the use of material and the labour force, these two subsystems should be kept separate and the grouping of information for the two accounting purposes should be different.

For instance, in the main financial accounting ledger only the total sum of purchased material is handled and lump sums are registered at company level, while in management accounting the use of material is included in cost calculations and sums are divided among different cost centres. Basic information on material consumption is produced in stock accounting and directed to different cost centres and products, if necessary.

The same system is used in payroll accounting and sales statistics.

(d) Financial accounting

As mentioned earlier, this kind of accounting is normally regulated by national laws or other official directives. The principles differ from country to country and therefore it is not possible to go deeply

into this aspect of accounting here. There are, however, two important parts of financial accounting, the balance sheet and the profit and loss account.

The purpose of a balance sheet is to tell, first, where the funds given to the company are directed, and second, where they came from. These statements give a daily picture of the situation.

The purpose of a profit and loss account is to indicate the profitability of the company. The statement is connected with a certain period (a year, a quarter).

(e) Management accounting

As already mentioned, management accounting basically follows two things, first, organizational responsibilities for incomes and costs, and second, profitability of products.

The basic problem in both cases is how to direct incomes and costs, either to the organizational units or to the products. The solution is a coding system which is necessary in order to split company level costs into detailed parts. This system is described later on.

In a functional organization it is quite easy to build up a management accounting system. Each function prepares its own budget for those costs for which it is responsible. The sales organization gives its plan in monetary terms with regards to incomes and also the sales and marketing costs of the sales department. The production, maintenance and administration departments give their cost budgets.

If there is a profit centre organization, the picture is as shown in Fig. 8. In this example, there are three profit centres (P/C), one each at the sawmill, plymill and furniture plant, and an overall administration for the whole company.

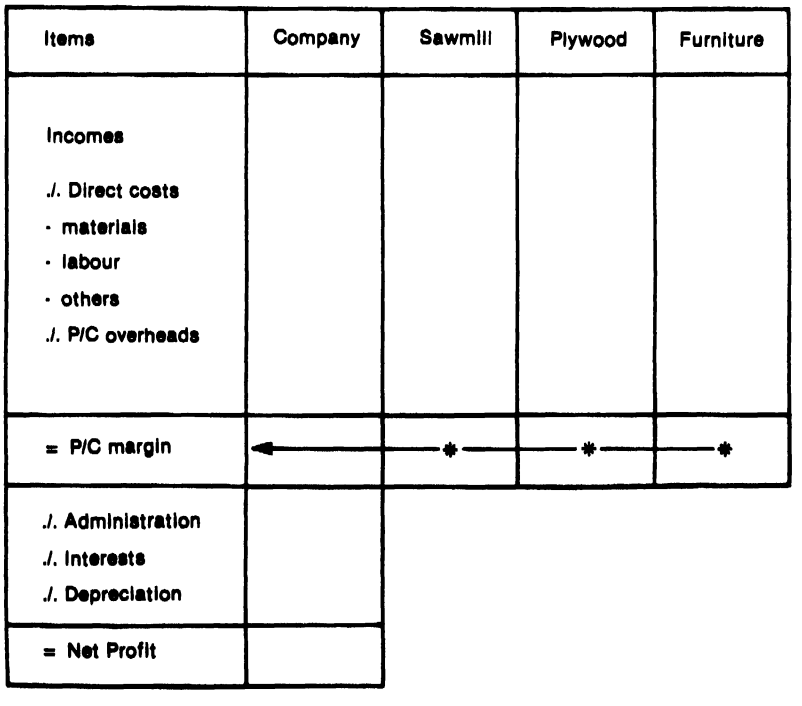


Fig. 8 MANAGEMENT ACCOUNTING SYSTEM IN A PROFIT-CENTRE ORGANIZATION

In this case, the company consists of real profit centres, which means that all units have their own production, sales and maintenance functions. In this situation, it is easy to calculate profit centre results or margins, and then check that there is enough margin to cover the overall overheads, interest and depreciation. Unfortunately this is in many ways too simplified an example. In actual situations the challenge to management accounting is much more complicated.

When a functional P/C organization produces many products from the same resources, the most difficult task is to determine the profitability of each product. Unfortunately there is no easy way to solve this problem. If a company is capable of handling the matter with a complex coding system, it is easy to keep the management informed of product profitability. If, however, this must be handled manually and with a slow information network, serious compromises must be made. In this case, one approach is to prepare separate calculations a few times a year and simply divide the overhead costs among the products in accordance with cost-sharing procedures. Incomes and at least a part of direct costs, which normally refer to new material, are quite easy to relate to the respective products.

(f) Budgeting procedure

In a corporation which consists of several companies, a multilevel budgeting process must be used. The main steps to be followed are as follows:

A. Corporation level instructions, including:

- Description of budgetary systems to be followed (especially when they have been changed);
- Accounting rules and other clarifications where necesssary;
- Overall forecasts of the economic situation, export targets, investment possibilities;

B. Preparation of sub-budgets in companies

B.1 Preliminary balancing overview where the operational possibilities and needs will be taken into consideration (see section 1.4).

B.2 Sales budget allocation:

- Sales revenues budgeted both in quantities (information obtained from operative planning) and in unit prices;
- Sales revenues divided by customer groups (export, local, inside transfers);
- Sales revenues budgeted by product groups;
- Sales costs budgeted as a separate cost-centre budget.

B.3 Production and inventory budgets where each head of a production line has to prepare:

- Budget of material and labour used;
- Production overhead budget;
- Forecast of capital expenditure requirements.

B.4 Logging budget:

- Logging, hauling, transportation, etc. costs budgeted by compartment;
- Logging overheads budgeted;
- Needs for capital expenditures forecast.

B.5 Maintenance budget:

- Maintenance costs planned and divided 1) by production units and 2) by machinery/equipment;
- Needs for capital expenditure arising from maintenance aspects forecast.

B.6 Administrative budgets:

- Each staff head to forecast the costs for activities under his responsibility;
- Chief Accountant to calculate financial costs (costs of interest, depreciation, etc.)

C. Company summaries

The information from the above-mentioned sub-budgets is summarized as follows:

- Summary of operative plan which supplies information on the key issues of the company for the coming year (sales/-production quantities, prices, relevant ratios, main actions to be taken);
- Profit and loss budget of the company;
- Capital expenditure budget (funds for fixed asset investments and additional working capital);
- Balance sheet of the company;
- Cash flow.

In all summaries a uniform budget form should be used. This will help the summarizing procedure in the Head Office.

D. Head Office sub-budgets

Simultaneously with the preparation of company budgets, the Head Office managers have to prepare their budgets dealing with the costs for which they are responsible. Capital expenditure for Head Office equipment has to be planned at this stage.

E. Corporation summaries

All company main budgets and Head Office budgets are brought together and the following summaries must be prepared:

- Short summary of the corporation's operative activities (sales volumes, raw material requirements, degree of utilization, key actions in each company, etc.);

- Consolidated profit and loss budget;
- Consolidated capital expenditure budget;
- Consolidated projected balance sheet;
- Consolidated cash flow projection.

It is assumed in this example that the companies have functional organizations and therefore the sales of all products in phase B.2 and production costs for each production line in phase B.3 are budgeted. When there are profit centres in the organization, the procedure is slightly different for these phases.

(g) Basic data collection

For budgeting, but also for monitoring performance, there must be a system which can be used to divide incomes and costs among the different categories in both financial and management accounting. The two basic systems are described in broad terms below. The first is the chart of accounts code and the second the list of profit and cost centre codes.

(h) General structure of account codes

The suggestion made here is based on the decimal system and it is assumed that the need for detailed management accounting information can be satisfied with three digits. The needs of an official, i.e. financial, accounting can be handled with a three-digit code, but companies must be prepared to add another digit if management information needs are great.

The purpose of account codes is to identify the items of profit and loss at all organizational levels and the items of the balance sheet at corporation and company levels. These accounts could, for instance, be grouped as follows:

100 series	Accounts of incomes
200 - 700 series	Accounts of expenditure
800 series	Accounts of assets
900 series	Accounts of liabilities

Because the use of balance sheet accounts (800 and 900) depends on national laws and other regulations, it is not practicable to go into details here. The use of income accounts depends on the product/market structure of the corporation and has to be handled case by case.

Concerning the expenditure group (200 - 700), some general suggestions are made. The use of digits might for instance be as follows:

200 series	Use of direct material
300 series	Use of indirect material
400 series	Manpower expenses
500 series	Premises and office expenses
600 series	Other operative expenses
700 series	Financial and other expenses

A more detailed use of digits in the code structure of manpower expenses might be as follows:

401	Direct wages (product bound)
402	Indirect wages
403	Salaries
404	Workers' overtime
405	Staff overtime
420	Local travel costs
421	Overseas travel costs
.	
.	
430	Training expenses
.	
.	
450	House rent & accommodation expenses

Detailed use of digits must be decided case by case and this kind of study should be performed carefully, because the structure of accounting codes is the foundation for all kinds of accounting, both official and managerial.

(i) General structure of profit and cost centre codes

Accounting codes give information only at company level. In management accounting, however, it is important to collect information from smaller units rather than from the company as a whole. For this purpose another code system is needed, which must be connected to the accounting codes. The accounting code tells what kinds of costs are used and the cost-centre code tells who in the company has used them.

The structure of cost centre codes depends on the organizational structure of the company. In most cases a three-digit code is long enough to give the necessary information. This code structure should be logical. If the decimal system can be used, it is easier to remember the meaning of codes.

As an example, the following shows a part of the cost-centre codes of an imaginary forest industry company.

1. Logging organization

10. Logging manager's office
11. Compartment 1
12. Compartment 2

19. Repair shop for vehicles

2. Sawmill

20. Manager's office
21. Sawline A
22. Sawline B

3. Plywood factory

If the two above-mentioned coding systems are connected they can produce more information and different kinds of information, e.g. code 404 - 22 tells how much the workers' overtime costs are in Sawline B.

(j) Reporting

The normal budget reports in this paper look like budgets except, of course, that actual figures and deviations are added. The reporting should concentrate on the key parameters and should be analytical. Good tools which should be used whenever practicable are graphs.

2. STRATEGIC HUMAN RESOURCES MANAGEMENT

2.1 Introduction

Three core elements are necessary for firms to function effectively:

Purpose and strategy

An organization has to have a reason for being a means for using money, material, information and people to carry out its purpose.

Human resource management

People are recruited into the organization to do jobs necessary to achieve the goals of the company, form its organizational units, perform different functions and attain the targets of individual positions.

Performance must be regularly monitored. Both monetary and non-monetary rewards must be given to keep individuals motivated and productive.

Fig. 9 presents basic elements of interrelated systems in the work environment.

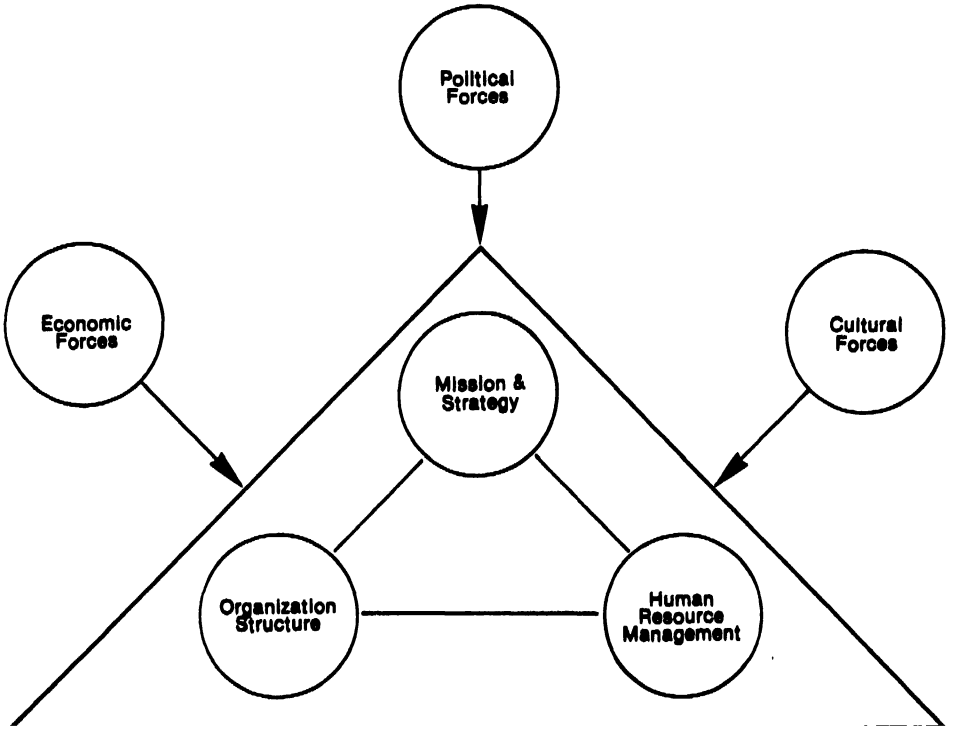


Fig. 9 INTERRELATED SYSTEMS IN THE WORK ENVIRONMENT

In this paper, focus is on elements in the management of human resources.

In general, these elements consist of:

- Selecting personnel;
- Setting the goal;
- Developing incentive and other motivational systems;
- Observing and evaluating performance.

Basically, all these areas are decisive in executing the strategies successfully.

Experience has shown that perhaps the third one is usually the most important and also too often the most neglected, therefore it contains the biggest development potential.

The development of monetary incentive and other types of motivation can be divided into two parts as illustrated in Fig. 10.

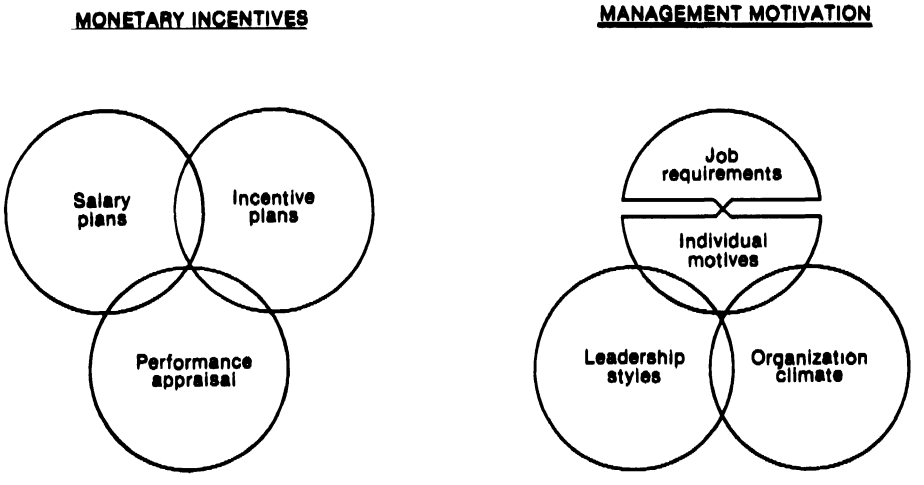


Fig. 10 MONETARY INCENTIVE AND OTHER TYPES OF MOTIVATION

2.2 Monetary incentives

Generally speaking, the overall level of payment in a country is heavily dependent on economic, political and cultural forces. Within a company, the level is dependent mainly on industry affiliation, geographical location, job market conditions, size of the company and company profitability. The salary differences within companies are often determined by factors like scope of the job, length of service/experience and performance.

From a motivational point of view, the methods used to determine differences in payment within a company are the most important.

Management payment usually consists of three elements. These are salary, bonus or commission and fringe benefits. The importance of these in the total payment mix varies greatly between different countries and types of industries.

2.2.1 Deciding the difficulty of the job by using job evaluation

The most useful tool in determining the base salary structure is job evaluation.

Its purpose is to place all jobs in the organization into their appropriate order of rank from most difficult to least difficult, and to work out the proper "spacing" between jobs. The process involves several additional considerations:

- Job evaluation deals with jobs and not with individuals or job titles;
- An evaluation focuses on the organization structure as it actually exists, not as it might or should be;
- Evaluations are not a tool for determining staffing levels or efficiency;
- The evaluation process is inherently subjective.

A variety of useful job-evaluation methodologies exists. They cover the range from simple job ranking to more detailed and structured point-counting systems.

A point-counting system has many advantages for large, diverse organizations. It is easier and more objective to evaluate one or two relatively limited factors independently than to attempt an overall evaluation of the whole job.

Because of the large number of widely different jobs in many organizations, no one person or group usually knows enough about all of them to compare them fairly. Using a predetermined set of point values allows different groups to operate in a common framework.

There is considerable consensus on the factors which should be included in job evaluation. The factors included in specific job evaluation systems reflect both the overall consensus and the varying sets of employees covered. The weighting of factors varies widely from one evaluation system to another.

The structure of the system which was originally designed by the Swedish SKF Company for managers and today is widely used internationally, looks as follows:

Factor / Degree	1 Education	2 Experience	3 Scope of activities	4 Interpersonal skills	5 Kind of problem	6 Instructions received	9 Personnel/ budget superv.	10 Subordination level
1	15	15	10	10	15	15	10	5
2	30	30	20	20	30	30	20	10
3	45	45	30	30	45	45	30	15
4	60	60	40	40	60	60	40	20
5	75	75	50	50	75	75	50	25
6		90	60	60	90	90	60	
7			70	70	105		70	
8			80	80				
9			90	90				
10			100					

Fig. 11 DEGREE VALUE BY FACTOR

2.2.2 Annual incentive plans

An important consideration in planning monetary incentives is the division of total cash compensation between salary and bonus. This relates to the short-term and long-term performance orientation of the overall programme. For executives in industrial companies, international surveys indicate average cash bonus levels at 10 to 40 percent of base salary. However, there are wide variations between different countries, industries and companies.

Decisions on who is eligible for a bonus and who is not are often difficult to make. Sometimes job-evaluation results can be used to determine eligibility. Positions which can and do have a meaningful impact on the company's performance should be included.

The amount of potential bonuses should be derived. The total of salary plus the potential annual cash bonus should be realistic and in line with pre-established guidelines or ranges.

Cash bonus plans are usually based on one of several fundamental approaches. One approach involves complete discretion. Another is to pay an executive a specified percentage of profits over a certain threshold. A third is to establish a bonus pool by formula and allocate individual awards from the pool. Another is to use performance targets and relate bonuses to actual performance as against the target.

Incentive plans usually involve more than one performance criterion. A simple plan might include only company and individual performances. The complex plans typically found in larger companies use two or more criteria.

Once the criteria to be included in the plan have been established, the relative importance of each should be determined. The weighting of factors varies, depending on the position of each within the overall organization. Senior company executives should be highly dependent on company performance. Divisional executives should be judged on both division and company results, with division performance weighted more heavily. Staff managers' incentives should place a strong emphasis on individual performance. Criteria to measure performance should be chosen carefully. A number of factors might be used to measure company or division performance: operating income, earnings per share, return on investment, return on assets, return on stockholder equity, personnel efficiency (revenues per payroll cost).

The selection of one or more of these factors depends on the current situation.

> What is the company's general strategy? What are the primary concerns of senior management?
>
> Based on this, which factors have most meaning and which have little or none? Which are the most suitable?
>
> Can they be accurately measured? Will they be meaningful or acceptable to participants?

Limits on bonus pay are often desirable. Despite careful planning, management cannot anticipate all possible situations that might occur. Limits serve to ensure that the programme remains reasonable.

2.2.3 Performance appraisal

Performance appraisal is often the key to salary and bonus plans. We believe that it will become the central compensation issue in many countries during the next five years. The results of performance appraisals often provide the basis for major differences in raises and bonus payments. This is why a performance appraisal has a strong motivational impact and thrust.

There are many appraisal techniques. Any approach is useful provided it embodies several crucial characteristics. Job-related, observable and measurable factors should be covered. There should be mutual preagreement on goals and criteria. Feedback and communication should be frequent and effective.

Typically a performance evaluation programme has three basic objectives:

1. To identify development opportunities and needs;
2. To provide a basis for salary increases and bonus awards;
3. To identify individuals who may be promoted.

The programme itself involves several steps. Each manager, in conjunction with his supervisor, works out a set of goals and plans for the coming year. Measurement criteria are also agreed upon. These are subject to review and approval by senior management. The progress of the individual manager toward specified goals is monitored during the year with appropriate feedback. Toward the end of the year, his performance related to his goals and other job-related factors is evaluated. A formal appraisal form is used to guide the process and serves as a permanent reference document.

2.3 Management motivation

2.3.1 The concept of management motivation

Professor David McClelland and his associates at Harvard University have been studying three motives - the need for achievement, the need for affiliation, and the need for power - for more than 30 years. Today the empirical evidence that has been compiled is impressive, and the work that has been done in assessing human resource potentials and in developing skills in managing people's motivation has brought immense benefits to both commercial organizations and government institutions all over the world.

The concepts that have been derived from this research work have strong relevance to manpower resource planning in an organization, as well as to the understanding of entrepreneurial and economic growth. Not only are the concepts easily understood, they can also be translated into practical use, so that they become powerful management tools in managing people. These tools are highly applicable to the assessment of an individual's success in a job in relation to job demand, the assessment of the total human resource potentials in an organization, the diagnosis of organizational health, manpower and career-path planning, management and organization development.

2.3.2 The motive profile

McClelland and his associates have developed accurate culture-free assessment techniques to evaluate the strengths of the three motives in people and the motive requirements of jobs. The results enable a man to be matched specifically to a job. An illustration of the motive profile is shown in Fig. 12.

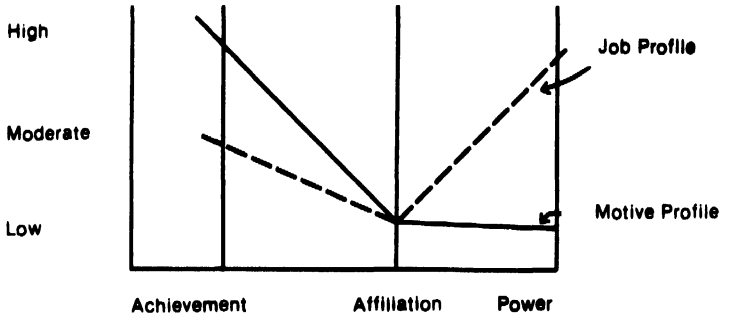


Fig. 12 MOTIVE PROFILE

The profile in this case shows that the person being assessed is dominant on the achievement motive and relatively low on both the affiliation and power motives. The graph indicates that in terms of motivational requirements the individual, all things being considered, does not fit the job, which calls for some achievements, no affiliation and a high degree of power.

Extensive surveys on a wide range of jobs have discovered that certain jobs or careers demand certain motives more than others. The motive profile of people who are successful correspond to the dominant motive profile of their jobs or careers. For example, it is found that successful businessmen or salesmen are invariably highly motivated for achievement. When it comes to managing people to achieve set objectives, the people highly motivated for power do a better job.

These are generalizations, however, - the exact motive strength of a job must be assessed, and when plotted on the same scale as the motive profile of a person, would decide the degree of match and therefore give a prediction of success or failure.

A motive is not behaviour but an energized state of an individual directed toward specific ends. While motive can help predict behaviour at the conclusive stage, behaviour need not necessarily determine the presence of a specific motive. For example, the real motive for a person to join a particular group may not necessarily be affiliation but rather, depending on what he thinks he can get out of such an association, achievement or power. The presence and the strength of a motive can be assessed only by probing the unconscious/subconscious mind through a technique that makes it accessible to measurement.

2.3.3 Factors affecting organization effectiveness

The factors affecting behaviour in terms of whether it is effective or ineffective in relation to a particular situation are governed by the dominant motive of a person and the dominant motive demand of a situation. In the context of an organization this is expanded to include the motivational style of the manager and the organizational climate. This may be as illustrated in Fig. 13.

When these four factors are congruent and reinforce each other, that is, when the four segments merge into one, productivity and job satisfaction increases. When they are out of phase or in conflict, productivity and morale usually suffer.

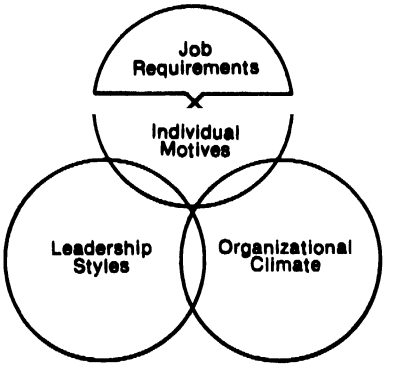


Fig. 13 FACTORS AFFECTING BEHAVIOUR

Under normal conditions, if people have not learned otherwise they display their dominant motives in all situations so that they are effective some of the time (when their motive profile happens to match the demands of the situation) but in the majority of cases we can safely predict that they are not so effective. However, people can learn to manage their motivation and the motivation of others for greater all-round effectiveness.

2.3.4 Developing the skills to manage motivation

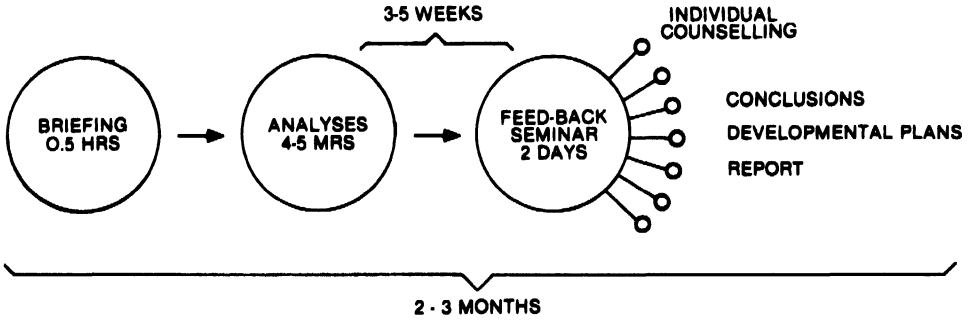
In general, motivation is spoken of in abstract terms. But there is a practical way in which an individual can come to grips with his own motivation and the motivation of others and develop the skills needed to manage motivation for greater effectiveness. Awareness of one's motivation can lead to change - change for improved performance and a more rewarding career.

Fig. 14 illustrates an exercise for programmed motivational development used in workshops to raise people's motives to a desirable level and to develop their skill in disciplining their thought patterns and behaviour to match appropriate situations. It is possible to develop people's specific motives to meet the demands of a situation.

These workshops have been tested extensively through professional consulting practice, and have become effective tools in management development.

ORGANIZATION MOTIVATION TRAINING I

OBJECTIVE. TO IMPROVE EMPLOYEE MOTIVATION AND JOB PERFORMANCE



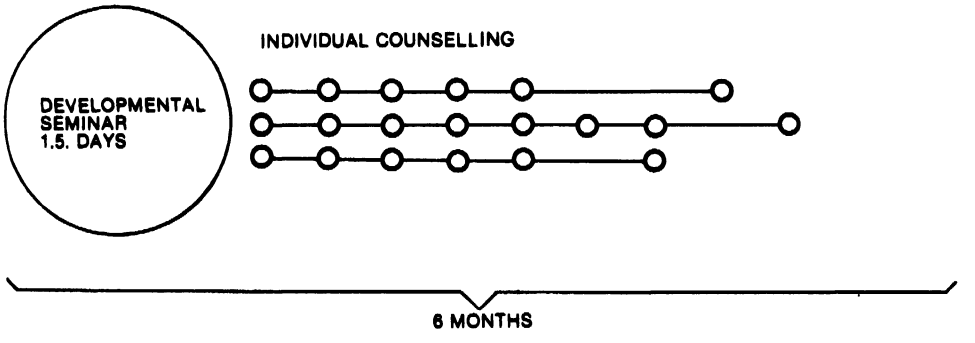
THE FOLLOWING ANALYSES ARE CONDUCTED:

- ORGANIZATION CLIMATE
- LEADERSHIP/MOTIVATIONAL STYLES
- JOB SPECIFICATIONS
- INDIVIDUAL MOTIVES

ORGANIZATION MOTIVATION TRAINING II

OBJECTIVE:

TO ACHIEVE OBSERVABLE, RELEVANT AND MEASURABLE CHANGES IN THE EMPLOYEES JOB PERFORMANCE IN 6 MONTHS TIME.



THE FOLLOWING PHASES ARE IMPLEMENTED·

- THE INDIVIDUAL UTILIZES HIS KNOWLEDGE BY MAKING SPECIFIC PLANS
- THE INDIVIDUAL REVIEWS HIS PLANS WITH THE CONSULTANT (2-3 TIMES)
- THE INDIVIDUAL IMPLEMENTS HIS PLANS

Fig. 14 EXERCISES IN PROGRAMMED MOTIVATIONAL TRAINING

DEVELOPMENT OF MOTIVATION

by

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1. INTRODUCTION

1.1 Two basic approaches to the problem

Development of work motivation has two basic approaches. One is that of the "scientific school of management" and has its roots in "Taylorism" (originated by F.W. Taylor at the beginning of this century). This approach stresses technical development in the workplace as a source of higher productivity. Modern manifestations of it are ergonomy, job design and job enrichment procedures, among others. This paper, however, stresses the other approach which is that of the "human relations" school. In this approach work motivation is seen as a special type of human motivation.

1.2 Defining work motivation

An individual is motivated when he produces and sustains behaviour which accomplishes objectives that satisfy a need. Work motivation, then, is shown in the behaviour of an employee who performs duties assigned to him and in so doing satisfies his personal needs. These personal needs may differ greatly. They may also vary within the same person at different times. These personal needs are not always conscious and may be as complicated as the motivation based on them.

1.3 Why work motivation is important

Increasing work motivation among employees has been a challenge to behavioural specialists in organizations because it normally requires less investment of money than other remedies which have equal effects on productivity. At the same time it increases satisfaction in the work. Conversely, an organization with a low level of individual work motivation has to fight constantly against poor output in both quantity and quality. This creates high expenses in personnel administration and can cause frequent conflicts between management and subordinates. The results of this may include inadequate involvement in the organization's objectives, and so an unhealthily high rate of personnel turnover, low morale, and misuse of company property.

2. WHO IS RESPONSIBLE FOR MOTIVATION?

In the development of work motivation, much depends on both theoretical and practical possibilities. Theories tell us where to look for these possibilities. Practical viewpoints let us see who in the organization is involved in developing motivation.

2.1 Sources of motivation

Generally, it may be said that developing work motivation in an individual depends on three factors: the individual, the workplace and other people outside the workplace.

According to the definition of work motivation, the most important factors are the needs of the individual. The motivational level of a person is dependent on whether he perceives the situation as fulfilling or not fulfilling his need for satisfaction. For him the most important consideration is his needs and how he can satisfy them while at work. This indicates that the key to the development of motivation is inside each individual. If there is no desire for work motivation within the individual, then nothing can really be done.

It is widely accepted that certain organizations have a poor motivational climate and others have a good one. They either discourage motivation or promote it. This indicates that there are some factors outside a person that affect his motivation. One can still say that a person motivates himself, but he does so only in certain organizational situations. If this is the case then there is something an organization can do to develop motivation. The situation can be changed intentionally (or may change accidentally).

In practice the motivation of a subordinate may depend on his superior. Some superiors have the ability to motivate their subordinates successfully while others cannot. To test whether this is not dependent on the differences among the subordinates their superiors can be changed. When the superior of highly motivated subordinates is changed, their motivation may vanish when the new superior takes over. The reverse may also be true. This cannot be explained simply by resistance to change.

In an organization with a poor motivational climate you may still find departments with highly motivated people. Motivation may exist even though there is no motivating superior. This happens because people can motivate one another or help one another to motivate themselves. In this situation the social needs of the personnel increase their motivation, despite the fact that the organization itself discourages it. Therefore, interpersonal relationships in the workplace can create high motivation. These relationships may include or exclude the superior.

Finally there is a large and heterogeneous group of people that might have an important bearing, for one reason or another, on a person's motivation. Among this group would be included family members, who could convince the individual that working hard has certain benefits. Or they could be friends or neighbours who may be impressed by career, promotion or work-related status. Common to this group of motivators is their provision of the model for needs or their use of social reinforcement to teach others to accept their needs regarding work.

2.2 Resources for developing work motivation

An organization cannot realistically affect those sources of motivation that lie outside it. Therefore resources have to be found within the organization itself. To promote high work-motivation in an organization it is not enough just not to hinder it; something must actively be done to encourage it at all organizational levels. To do this two general methods are available. These are company policy and motivated leadership.

2.2.1 Company policy

The general policies of an organization are normally made by top management. These policies can be either task-oriented or human-oriented or both. Normally, well-run business companies stress both task and human orientation and have values showing high regard for their personnel

(Peters and Waterman, pp. 13-17). This approach to personnel is not or has not been typical just for organizations with high performance, but the general situation today, at least in the old industrialized countries, favours it.

What is the situation in newly industrialized countries (NIC) or developing countries ? In developing countries the scarcity of economic resources makes it natural to rely more on the resources that are available, mainly human performance. The same is true, but for different reasons for NIC countries, as they have economic resources, but also find difficulty in coping with high technology.

Again the problem is concentrated on the human element. Thus there are good reasons for top management to work out a general policy that allows flexibility and encourages the development of motivation. There are specialized staff and personnel in larger organizations to handle the application of this policy. Normally, in practice, the task is left to administrative or personnel units or specialists. They are responsible for maintaining a motivating atmosphere in the organization. On an intermediate level, however, they are not the only ones with this task.

2.2.2 Leadership

Real and lasting effects on individual motivation can be conducted only through normal everyday work. Each individual is given work that he is supposed to perform according to the standards established by the organization, with proper responsibility to develop his work area. This development may be through planning, organizing the work and finding better ways to accomplish the goals and objectives of the organization. These activities are performed under the leadership of the individual's superior.

The superior has contacts with his subordinates for managerial reasons and is the closest person in the organizational structure to exercise leadership over the subordinate. So it becomes evident that the superior has the greatest opportunity, in the organization chain, to pass information horizontally or vertically on topics connected with the development of motivation, which demand either decisions at higher levels or actions by specialized staff.

3. THEORIES OF MOTIVATION

3.1 Choosing the theory

There are many theories on motivation, some more popular than others, although there are differences in their popularity. In work motivation the area becomes narrower and the number of theories accordingly, though there is still a wide variety from which to choose. Some apply better to a certain situation, some to a certain time span; some stress the role of a person's inner processes; some point out the importance of learning. They all have some truth in them and they can all be used, although the areas for their application differ. As a fair conclusion from this collection of theories, it may be said that a healthy person can motivate himself to do anything. Conversely, anybody can remain unaffected by any kind of motivation in any work situation.

Later on, the reader will see that theories have been selected on the grounds that they stress action, though this has meant that many other good theories have been discarded from this presentation.

3.2 Description of selected theories and their implications

3.2.1 Relationships between basic concepts

How does work motivation function in a person and how does each element of it affect the final result?

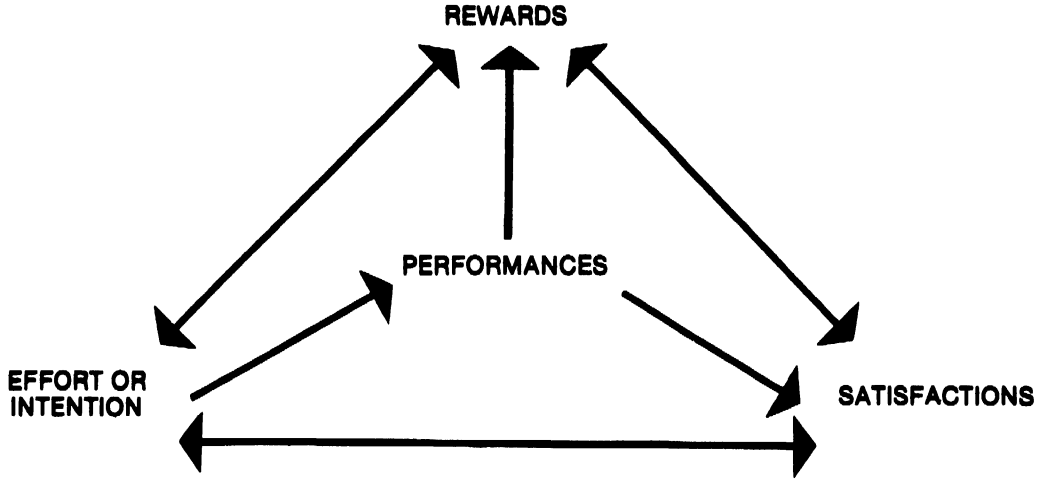

Fig. 1 SMITH AND CRANNY MOTIVATION MODEL

As represented in the model from Smith & Cranny, page 469, (Fig. 1), there are four concepts that have a value in describing work motivation. These are: effort (or intention), satisfaction, rewards (in the corners) and performance (in the middle of the triangle). Each variable in the corners of the triangle has causal effects on the others and is affected in return. For example, increasing effort increases the probability of rewards (psychological or economic compensation) and through that, satisfaction. According to this theory, individual effort can directly affect satisfaction and through it the rewards. As the arrows in the figure suggest, the effects of all three main variables are in both directions, but in the case of performance (middle of the triangle) this can be affected only by effort, though it has further effects on both rewards and satisfaction.

Smith and Cranny's model is not exactly a theory, but it gives a practical form to the relationships among basic concepts in work motivation.

3.2.2 "Classical" theories based on needs

These "classical" theories on work motivation attempt to explain the stage before actual effort is made, and what type of factors should then be taken into consideration. These are related to certain needs and the realities that determine those needs. If these realities are not taken into account, there will be no effort or rewards in the work and consequently there is no possibility of gaining satisfaction for the needs; naturally in this situation the desired performance will not be reached.

Two theories of this type are "classical" in the sense that they represent the first systematic attempts to specify the needs underlying work motivation.

"Hierarchy of needs"

A.H. Maslow's "Hierarchy of needs" (pp. 370-396) postulates that there are five levels of needs (see Fig. 2). An individual satisfies his needs beginning with the lowest level and proceeds to the next only if the needs on the lower level have been satisfied to a reasonable degree or can be satisfied at any time without too much strain. An individual proceeds from step to step until he can no longer advance to a higher level of needs. There is no end to need-satisfaction at the highest level, as this develops constantly.

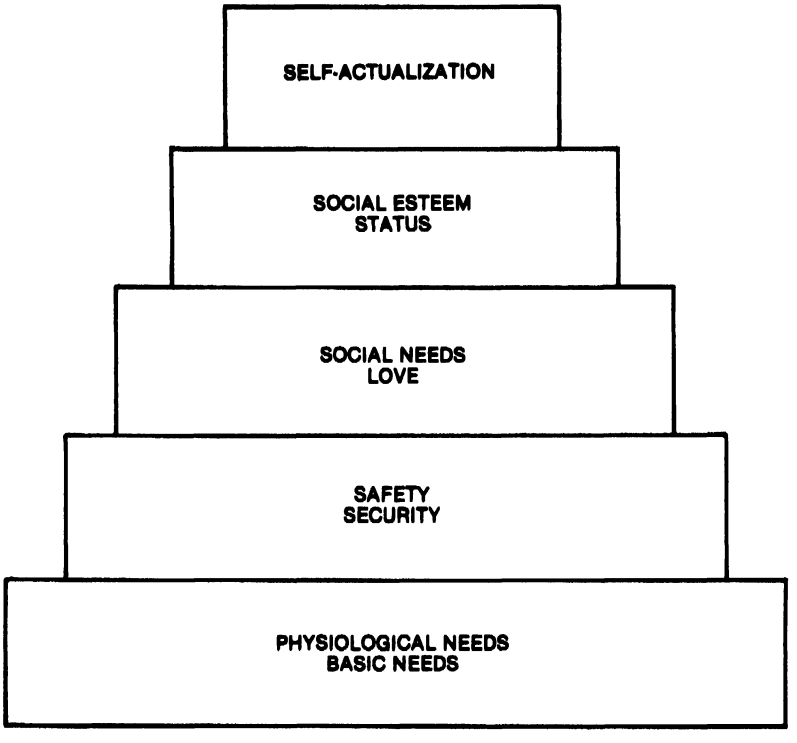

Fig.2 HIERARCHY OF NEEDS

The highest level of need-satisfaction is determined by what is important to the individual and what type of rewards he values. If the work he is performing does not relate to his level of needs, then he will not be motivated to work hard; for example, a person who desires satisfaction of his social needs is not content if he is rewarded either on the self-actualizing level (too high) or on the level of security (too low).

To apply Maslow's theory, we should know what the predominant level of needs in the organization is. This is necessary in order to make accurate conclusions; for example, for personnel policy. This can also be adapted to certain groups of people in the organization to ensure that the correct level of needs is taken into account when motivating and rewarding. Mistakes can occur when an attempt is made to motivate individual subordinates with the wrong level of rewards. Motivation will not be created because the rewards are not correctly interpreted. Trying to motivate people with the wrong need level will not give any satisfaction, but rather generate irritation and negative results.

It should be stated here that financial rewards are important for material satisfaction at the lowest need levels. In addition financial rewards may have symbolic significance as indicators of social and personal worth and status. So they have a broad range of meaning.

The limitations of financial rewards can also be seen, e.g. in work of low status because this cannot be compensated by only increasing pay or fringe benefits. Sometimes beliefs and traditions make it impossible for some individuals to perform a certain task no matter how much they are paid. In this case other needs are seen as being more important than monetary compensation.

The "two-factor theory"

Herzberg et al. (p. 141) have proposed an explanation of work motivation distinguishing between two types of factors which are illustrated in Fig. 3.

HYGIENE FACTORS	MOTIVATORS
Company policy and administration	Achievements
Technical supervision	Responsibility
Working conditions	The work itself
Salary	Advancement
Miscellanous	Miscellanous

Fig. 3 ILLUSTRATION OF TWO FACTOR THEORY

Herzberg later reinforced his findings with studies conducted in several countries. According to him, there are two kinds of factors connected with work satisfaction, or to be more precise, one kind with satisfaction and the other with dissatisfaction. "Motivators" are responsible for satisfaction. Herzberg pointed out that by eliminating factors that create dissatisfaction, you do not necessarily satisfy employees, but may instead generate indifference among them. He noted that the same was true even for motivators in the sense that only to increase these in number and strength did not increase work satisfaction. Reaching higher levels of work satisfaction was possible only when what he called the "hygiene" factors had been satisfied to acceptable levels and when part of the motivators were increased. As an alert reader will discover, there is some resemblance between the lower level needs proposed by Maslow and these hygiene factors. The same is true for the higher need levels and motivators.

As a practical conclusion it may be said that the factors responsible for dissatisfaction are mostly those that can be solved by top management with the help of staff specialized, for example, in personnel, training, ergonomy. Although many of the motivators also have an impact on the general policies of the organization, they have other qualities that are more closely related to the subordinate. A superior can achieve great improvement by delegating responsibility according to the readiness of the subordinate, training on the job, creating a healthy atmosphere and providing constant feedback.

3.2.3 Expectancy theories - effort and reward

Besides the classical theories on work motivation, there are also more recent ones. Some of them are grouped under the name of expectancy theories. These were originally presented by Vroom (page 178) and later developed by Porter and Lawler (pp. 12-13). The main idea in these theories is the function of perceived and actual rewards for effort and performance. Motivation is generated through the relationship between satisfaction and performance. Actual rewards which do not differ too much from the perceived rewards generate satisfaction and encourage an individual to perform well both now and in the future. In the reverse case, motivation decreases. The rewards in this situation can be received either from outside the individual (organization, superiors) or from within himself (feeling, emotions). They can also come from other factors (psychological, social, economic).

These theories are undergoing vigorous study. Some of the developments may be followed in three studies in "Organizational behavior and human performance" (Vol. 32, No. 1, 1983, pp. 23-24, 66-86, 124-143).

Although these theories are more exact than previous ones, and have a broader scope, unfortunately they have not yet been widely adapted to everyday work. To arrive at practical conclusions based on these types of theories, one should discover what the most important expectations regarding the rewards for an individual's effort are; and how these expectations could be met within the framework set by company policies, or according to the responsibilities granted to a certain superior. To develop this type of motivational approach to work further demands open relationships between the superior and his subordinate, good communication skills, a rather low turnover in personnel, and creative psychological instincts in the superior.

3.3 Approaches based on social interaction

3.3.1 The role of attitudes to work

In developing motivation, attitudes have a major role, because they determine what information is selected. It is typical of attitudes that they are strongly for or against something or somebody. Accordingly, they allow only the type of information that conforms to the attitude to enter the mind. It is not a general attitude everywhere that personnel should even feel motivation in their work. The cultural climate does not always encourage people to work hard. This can be true even within one region where different cultural groups exist.

In this type of situation, the major task for superiors is to point out the rewards and make sure that expectancy values are in line with performances on individual levels. This means that close supervision is necessary in order to give relevant rewards as soon as possible. The superior needs to be able to delegate power freely and possess a wide collection of rewards. Their range should cover different types of psychological encouragement for individuals, social rewards and reasonable economic facilities to compensate good performance. This makes the task of the superior difficult, because he must relate the reward to both the work and the social situation and at the same time he must be able to avoid complaints of favouritism, imagined or real.

3.3.2 Assumptions on human behaviour in work

General attitudes of superiors themselves might affect the performance of their subordinates, as shown by McGregor (pp. 33-34, 47-48). His x and y theories state that there are two basic ways to view human nature. According to theory x human beings must be forced to work because they are inherently lazy and try to avoid work. The role of

control and direction is important in this case and McGregor believes that this leads to conflicts among the subordinates. He points out that subordinates develop behaviour in work that can be described as unmotivated.

If the superior's attitude accords with theory y, he accepts that work is as natural to individuals as play. Given only appropriate facilities and a light hand on the part of the management, the subordinates will start to perform their tasks in a motivated way. Therefore, the responsibility for a good motivational climate in the organization is in the hands of the superior himself and depends on his assumptions on the basic qualities of human behaviour. "The forest echoes what you shout to it" is an old Finnish proverb that points out the same thing - a superior's attitude to his subordinates is reflected back by them and largely determines the outcome of any work situation. This is particularly well described by Harris, pp. 36-51.

3.3.3 The meaning of communication in motivation

Communication plays a positive role in generating motivation as it seeks understanding of why the work should be done. Communication also makes it possible for the subordinate to ask for details of the work, comment on it and even make suggestions regarding it. It also provides a way to transfer knowledge of the overall objectives of the organization to the members. This helps the subordinate to react correctly in unclear situations and gives direction to the development of his work. Communication takes more time than direction, but its advantages over direction lie particularly in the realm of motivation.

As pointed out in other sections of this paper, communication is a skill which can be used for different purposes; for example, finding out individual need-levels or what the motivators are. It can also be used in connection with supervision and to create a managerial style. In the list of characteristics and qualities typical of well-run business organizations, Peters and Waterman (p. 123) stress the overall importance of communications. There are communication techniques that are strongly recommended to managers who need to improve themselves in this area (e.g. transactional analysis).

4. EVERYDAY MOTIVATION BY THE SUPERIOR

Although there are many theoretical approaches to work motivation, there remain a few simple rules for increasing motivation at work. These rules are based on social learning and can be used in connection with any of the theories presented earlier. The only requirement is that the superior is rather stable in his views on what is expected work behaviour and what is not. Even then some extra communication skill is needed. The rules are as follows:

4.1 Give plenty of feedback

Plenty of feedback on their work performance should be given to subordinates. The more feedback they are given, the better are the possibilities that subordinates will learn what the expected work standards are, what is properly done and what is not, and how to develop their skills at work. Feedback can be given verbally as a comment on the work done. At other times it may be written. Written feedback generally has a stronger effect than verbal. Feedback can also be given by gestures and facial expressions.

4.2 Balance positive and negative feedback

Feedback can be either positive or negative. Positive feedback encourages subordinates to continue their performance in the same manner.

Negative feedback discourages them from doing things incorrectly. When no feedback is given, this is experienced in most cases as equivalent to negative feedback, because it shows no interest on the part of the superior in the performance of the subordinate. This becomes more evident in a situation where no response is given when a positive comment was expected. Because subordinates have been trained by various methods to do their work, they generally do things correctly. If fair principles are applied by the superior, then it is natural that positive feedback is more common than negative.

Positive feedback is a psychological type of reward. Normally, when performances are extraordinarily good, other rewards can be used - even financial ones. There is a wide scale of the rewards, just as there is in punishments that represent negative feedback. Psychological punishments should not be too severe, because they have a hidden tendency to show that the person in question is not "good".

4.3 Direction of feedback

Feedback should be correctly directed. Rewards are more effective when they are directed to the person in question, e.g., by saying, "You did a good job." Punishments are more effective and more accepted if they refer to the performance, result or the actual work, e.g., "This work was poorly done." By doing this, the superior shows respect to the person in question and helps him maintain his selfconfidence which is necessary in work. A reward should not be combined with a punishment. This might lead to unnecessary pondering and doubt about motives, leading easily to a situation where even the clearest reward is misunderstood and the result is opposite to the desired one.

4.4 Timing

Reward or punishment should be immediate. The sooner a certain type of behaviour is rewarded or punished the more quickly a change in behaviour is likely to occur. It is also possible that the time factor may distort a desired effect in the opposite direction; thus a reward given too long after the actual performance loses its positive effect and may even have a negative one. Delayed punishment, on the other hand, is experienced more strongly than punishment that is meted out soon after the unacceptable behaviour. In other words, as time goes on, the effect of a reward decreases and the effect of a punishment increases.

5. CONCLUDING REMARKS

Motivation can be developed either by technical and physical means or by concentrating on human issues or by both. In this presentation emphasis has been placed more on the human factor because motivation originates in psychology.

The development of an individual's work motivation depends on several factors, some of which are more or less outside the control of the individual. On the other hand, there are factors that can be affected by the organization as a whole, by its management, specialized staff and by every person with subordinates.

It should be remembered that there will not be any serious effort to improve motivation unless two conditions are met: positive attitudes toward the topic and readiness to communicate. Once these are present it will be possible to discover the motivational approach that is most appropriate.

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Demonstration of winching of logs with agricultural tractor (Photo: H. Seppanen)

PLANNING THE WOOD SUPPLY FOR A FOREST INDUSTRIAL PROJECT

Secretariat paper
introduced by

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1. INTRODUCION

The topic of this paper is the nature and the extent of planning which is necessary to ensure an adequate supply of logs or fibre for a forest industrial project.

The earliest stage of forest activity in a region has frequently been the operation of small, low-capital sawmills. These mills have seldom been supported by well-planned logging operations but have operated spasmodically as logs have become available. Despite the lack of a sustained wood supply, such mills often operate under local market conditions which permit them to earn sufficient returns to satisfy their owners. Their contribution to the overall economy, however, is slight and the mills are very susceptible to competition from better-planned enterprises.

In contrast to these earlier small, low-capital sawmills, modern conversion plants tend to be much larger, involve substantially higher capital costs, produce more sophisticated products and sell these products on markets which require a continuous supply of well manufactured goods. These modern plants must operate consistently at or near capacity to be competitive, to supply the market and to yield adequate returns on invested capital. Such plants, when they are successful, can make substantial social and economic contributions to the region in which they operate, but to be successful they must be supported by well-planned wood supply operations. It is to this type of forest industrial enterprise that this paper is directed.

The planning of the wood supply for a forest industrial project will vary greatly with the stage of forest development which has been reached in the region concerned, as well as with the nature of the project. On the one hand, a new plant may be projected to complement existing industry in a region where a high degree of forest development has already taken place - for example, a pulp mill or particleboard plant may be projected to utilize residues from existing sawmills, and logs which are unsuitable for sawing. In such a case, raw material planning should cover the acquisition and assembly of the sawmill residues and low-grade logs as the main source of supply, with primary harvesting only for the additional volumes necessary to supply the projected plant fully. On the other hand, a sawmill, veneer mill or pulp mill might be projected for a region where no forest activities have yet taken place. In this case a great deal more detailed planning and forest studies will be required to assure a good supply at a minimal cost.

The nature of the plant may also affect the degree to which studies, particularly studies of the forest, must be carried out. For example, forest studies for a veneer plant, which requires logs of a particular species, size, length and quality, must be much more detailed than those for a sawmill which can process a wide range of species and sizes. (It is seldom possible to harvest veneer logs alone; usually they must be sorted from forest-run production harvested primarily for other purposes.)

The nature of the forest, the terrain and topography and the infrastructure within a region may limit or obviate studies which might be required in other regions. An example is the use of water transport. Obviously, if there are no navigable waterways, water transport need not be considered. In some regions the choice between water, rail or road transport may be a difficult one.

The following sections of this paper have been written to cover, from the standpoint of wood supply, studies and analyses which might be required under a very broad range of conditions. The specific situation will determine the detail which is required for a particular project.

One of the greatest dangers in developing a forest industrial enterprise is to assume that wood supply is a simple process which will more or less look after itself. In both the developing and the developed world, many forest industrial enterprises have either failed or have suffered grievously because this assumption has been made. Wood supply is seldom, if ever, such a simple process. Instead it is one which requires well-laid plans, trained workers, skilled and experienced managers, and ample funding if an adequate, sustained wood supply is to be assured at an optimum cost.

For a successful forest enterprise, there are a number of principles which must be considered at a very early stage of development:

1. The enterprise must be planned in accordance with the volume, quality and extraction cost of the available wood supply, as well as with the available markets and the technical considerations.

2. Investigations and analyses of the forest resource must be made and preliminary plans for forest harvesting (and/or wood purchases) must be completed, before decisions on the nature, location and productive capacity of the plant can be finalized.

3. Detailed planning for forest operations, however, cannot be completed until the nature, location and capacity of the plant have been decided.

4. As an expensive road network and/or other transport facilities are usually required for forest harvesting, higher wood costs must be expected if plant requirements restrict the harvest to a small portion of the available timber - veneer logs, for example.

5. If a conversion plant is to operate efficiently, adequate supplies of raw material must be on hand at all times. Consequently, forest harvesting activities must commence well before the plant starts up and must be sustained at a rate consistent with the needs of the plant.

6. Transportation facilities and an adequate transportation network (usually roads) must be in place before harvesting can commence. The planning, location and construction of roads must commence two years or more before they are required for use.

7. Like a conversion plant, a forest harvesting operation must have suitably trained workers to produce and deliver logs, and trained, experienced managers to plan, direct and control the operation.

8. As with all industrial enterprises, a forest harvesting operation must have adequate funds to provide for capital expenditures and for working capital.

Many of the studies and analyses and much of the planning for harvesting operations must be undertaken during the feasibility study which is usually required before a decision is reached to proceed with the overall project. The feasibility work, however, must be expanded and detailed before final harvesting plans can be completed.

2. FOREST CONSIDERATIONS IN PLANNING THE CONVERSION PLANT

Forest industrial planning is not restricted to the wood harvesting operation. Forest considerations play a large part in the planning of a mill.

2.1 Volume, type and cost of wood supply

The volume of suitable wood which can be made available and the cost at which it can be processed are major constraints in the development of all forest enterprises. Consequently, a substantial body of information on the potential annual wood supply - volume, species, dimension and use characteristics - and on estimated costs of delivery to potential mill sites must be available to the planner at a very early stage of the project. Quite frequently, studies and analyses of the forest resource are both costly and time-consuming but they must be carried out thoroughly if the enterprise is to be developed on a firm foundation. Failure to do so can lead to a waste of effort and capital on a plant which will never perform to its full potential, nor to its projected profitability.

The cost of wood as logs frequently amounts to 50 percent or more of the total operating cost of a conversion plant, and transportation forms a substantial portion of the log cost. Consequently, in determining the site of a conversion plant due consideration must be given to location in relation to wood supply sources and to facilities for wood transportation. When there are several site options, wood transportation costs may well be the decisive factor in making the selection.

Forest harvesting requires development of a transportation network throughout the forest. In most cases the cost of this network must be amortized against the volume of wood harvested. Any restriction on the volume which can be harvested per unit of forest area will result in a higher cost of wood. For example, road amortization per cubic metre of wood harvested will be about ten times as high if the harvest is 10 m^3/ha as it would be if the harvest were 100 m^3/ha in the same forest.

Generally, a veneer mill or plywood plant is most selective in its wood requirements, a sawmill somewhat less so, and a pulp mill or particleboard plant least of all. A veneer mill operating alone, then, can expect substantially higher harvesting costs than one operating in conjunction with a sawmill or a group of sawmills. In the same way, a sawmill operating in conjunction with a pulp mill or vice versa may well obtain lower wood costs and a higher value of recovery from the forest resource than any single-product unit. Wherever markets and forests permit, these factors should be taken into consideration in planning forest development. Unless trees which can produce veneer of very high value are available in adequate supply, it is unlikely that a harvesting operation for veneer logs alone can be successful. The chances of success are much greater if the veneer mill can be operated in conjunction with a sawmill or group of sawmills.

Planners for the project must analyse the forest resource in detail together with market opportunities, technical processes and social requirements to reach decisions on the nature, location and productive capacity of the projected conversion unit. As soon as these decisions have been reached, a budget and timetable showing the volumes required both during the start-up period and through subsequent years must be

prepared and a log specification or specifications describing the required type or types of wood must be compiled. This budget, timetable and specification then become the targets for the wood supply organization.

2.2 Wood handling at the plant

Forest considerations enter the detailed design of the conversion plant in a number of ways. An obvious example is the difference in design for a sawmill which will use small, low-density softwood sawlogs, from one which will use large dense hardwoods. Examples which are less obvious are the differences in waste-handling facilities between sawmills handling essentially sound logs and those handling very defective logs; the differences in dry kiln requirements for species with different drying schedules; and the difference in chipper-sharpening facilities at pulp mills using log supplies which contain greater or lesser concentrations of silica.

Adequate forest data must be available to the mill designers to ensure that all wood handling and processing systems are consistent with the characteristics of the specific wood supply. Where the project is pioneering in previously unexploited forests or in using previously unused species, original research and wood testing may be required to develop these data, both for mill design and for market analysis.

Log handling facilities at the mill, logging and transportation systems cannot be planned in isolation from one another, but should be developed for the best overall results in both milling and harvesting. For example, delivery of tree-length logs might be advantageous from a harvesting viewpoint but would require breakdown facilities at the mill which would not be required if short logs were delivered. In such a case, the decision regarding log lengths should be based on the lowest cost - both capital and operating - for both harvesting and milling. Different log transport systems - road, rail or water - will, of course, require different log handling facilities at the mill. For both truck and rail delivery, sufficient unloading and log handling equipment must be installed to ensure a prompt turn-around of the logging trucks or railway wagons.

Log storage areas at the mill must be adequate to assure a sustained supply of raw material regardless of daily fluctuations in deliveries. In some regions, climatic conditions may prevent logging for several months in the year. In such cases, storage yard capacity must be adequate to carry the mill through the down-season. Although in some circumstances storage remote from the mill may be satisfactory, in most cases lower costs can be obtained by using a storage yard at the mill site. The length of the logging season, then, can have an important influence on the site plan of the mill.

Mill storage areas should be equipped to provide protection against fibre losses from fire, insects and disease and from deterioration of the logs in storage. The nature of the log supply will, to some degree, determine the protective facilities necessary.

3. CONSIDERATIONS IN PLANNING WOOD SUPPLY

Data on the forest itself are of primary importance in determining both the feasibility of a forest industrial project and the procedures which are necessary to ensure a sustained wood supply at optimum cost. In addition, a large number of factors not directly connected with the forest can influence wood cost and hence the feasibility of the operation

and/or the amount of preparatory work which must be done before wood deliveries to the plant can be ensured. Some of these factors have already been mentioned in the introduction to this paper. Each will be discussed in greater detail in the subsections below.

3.1 The forest

Planning for a forest industrial enterprise involves a thorough knowledge of the forest which will provide the wood supply, and of the species which make up the forest.

A fundamental requirement is a knowledge of the characteristics of each species and the effect which these have on the use to which the wood will be put, the manner in which it must be handled and the markets in which it may be sold. Examples of such characteristics include shape, form, density, durability, colour and figure, mechanical properties and chemical or mineral additives in the wood. Most of these data are readily available for species in common use but they may not be available for forests or species which have not been previously exploited. In the latter case, original research must be undertaken before the feasibility of a particular project can be assessed.

While general information on species characteristics is important in planning the enterprise, more specific information on the actual forest to be harvested is also vital. This specific information includes the following:

- The volume (m^3) in the projected wood supply area by species and by forest type;
- The volume per unit area (m^3/ha) by species in each forest type;
- The diameter class distribution of the mature trees in each species or species group;
- The age class distribution of the trees in the forest;
- Estimates of the incidence of defect in each species;
- Estimates of the volume that is suitable for a particular purpose, e.g. veneer logs or high-grade sawlogs. 1/

Inventories which give some information on most of the statistical data required for planning have been developed for most forest regions; if the forest concerned in the enterprise has not been inventoried, an inventory must be the first step in the planning process. However, great care must be used in applying inventory data to a particular project. It is very important that the data are up-to-date and represent the forest as it is now and not as it was at some time in the past. Moreover, data for subregions or particular forests may vary quite substantially from average data which are accurate for the region as a whole.

In addition, inventory volumes may include the total wood in the bole of a tree or even in both bole and branches; such volumes must be substantially modified to obtain the volumes which can actually be harvested and processed economically. Again the inventory may show the

1/ Such estimates are important even when the project is not highly selective in wood use. Wherever markets can be found, high-grade logs should be directed to the use which will yield the greatest returns.

incidence of trees of species which are suitable for a particular product (veneer, for example) but it is most unlikely to include sufficient data to develop estimates of the volume which will meet size, straightness and quality requirements for that product. Most frequently, inventory data must be supplemented by local surveys (or local experience) to obtain data specific to the enterprise. The more highly the wood required for the project is specified and the more varied the forests from which it is to be harvested, the more important detailed local surveys become. In many harvesting operations, forest surveys (timber cruises) are carried out for each operation area as it enters the harvest plan.

Many forests throughout the world either are under management for sustained yield now or will come under management as soon as it becomes practicable. A management plan limits the annual harvest to the allowable annual cut and frequently designates a cutting cycle. Both these estimates are most important in planning the wood supply and they must be made during the feasibility study. Silvicultural considerations may call for partial cutting so that the actual harvest per unit area may be only a fraction of the potential indicated by the inventory data.

When all the required forest data have been obtained and analysed, the following preliminary estimates can be developed:

1. The volume of wood suitable for the projected plant, which can be harvested each year;

2. The potential production per unit of area;

3. The forest area which must be harvested each year for a given level of production;

4. The roads or other transport facilities which must be built each year to develop the required production.

3.2 Other forest industrial activities in the region

Other forest industries in the region may also have an important bearing on the planning of the wood supply for an enterprise. To the extent that such enterprises rely on the same forests for similar types of logs, they will limit the wood supply to a new project. On the other hand, existing forest enterprises may provide an important source of supply for the new project. For example, sawmills may provide residues and low-grade logs to a new pulp mill or they may sell veneer logs to a new veneer mill. In such cases, mutual advantages would be achieved through local exchanges as each type of industry could use the wood best suited to its product.

Preliminary harvesting plans based on forest data alone should be modified to reflect wood purchases or exchanges. However, the supplies of purchased wood are somewhat less reliable than supplies from more readily controllable harvesting operations. Consequently, the harvesting plans and organization of the new enterprise must be sufficiently flexible to increase harvesting when the supply of purchased wood falls below expectations.

3.3 Terrain and topography

Terrain and topography enter into planning for forest harvesting in a large number of ways. Some examples are given below.

First, terrain and topography may bring about a reduction in the allowable or practicable harvest. In steep, mountainous areas some forests may be designated as protection forests in which no harvesting

can take place. Other areas may have terrain so steep and rough that no harvesting is practicable, even if it is permitted under environmental regulations. If these constraints have not been adequately recognized in the forest management plan, it may be necessary to reduce the allowable annual cut proportionately.

Second, the terrain and topography affect the selection of a logging system and this in turn affects the delivered cost of wood. Slope is very significant in this regard. Most manual systems are practicable only downhill or on level ground; skidders are most effective on slopes below 30 percent; tracked vehicles can be effective on slopes up to about 50 percent; and steeper slopes can usually best be harvested by cable systems. Very moist swampy areas can sometimes best be harvested by developing a system of canals from main waterways to individual trees or groups of trees.

Third, roughness of the terrain can affect the productivity of the selected logging system. For any degree of slope, harvesting will be easiest on even ground and most difficult on very rough or broken ground.

Fourth, terrain and topography will affect both the method and cost of road construction and may affect the amount of road required. Road construction will be difficult and costly both in steep, rocky terrain and in swampy areas where the soil moisture content is high. The occurrence and location of gravel pits and road quarries will also affect road construction costs as the cost of ballast in places increases rapidly with the distance it must be hauled. In addition, the incidence of protection forests, areas difficult to log and non-forest areas will affect the amount of road required as such areas must be traversed to reach the forests beyond.

Fifth, rivers and other waterways are frequently impediments to logging, but in some cases may provide avenues for log transportation. Bridges are expensive, so that the need to cross a large number of streams will greatly increase the cost of a road network. The cost of crossing major rivers more than once may be prohibitive so a main road system may have to be built on both sides of the river. On the other hand, where waterways are navigable and provide access to the mill site for rafts or log barges, they may substantially reduce the cost of transportation.

Topography and terrain are seldom uniform throughout a large forest so that logging planning, particularly in the long term, requires a broad knowledge of terrain (and timber) conditions throughout the forest. This can be gained from aerial photographs and from maps which show topography and timber types, but these must be supplemented by reconnaissance surveys made by experienced foresters or forest engineers. Ground reconnaissance is time-consuming and costly and can cover only a limited area; a better overall impression can be gained quickly through the use of small airplanes or helicopters. In contrast to the broad knowledge required for long-term planning, short-term planning requires a detailed knowledge of conditions in a specific area. For short-term planning, thorough ground surveys are usually required.

3.4 Climate

Climate is also of importance in logging planning as it can limit the time available for harvesting operations each year. In some temperate regions, harvesting is limited to the summer months because of excessive snow in the winter; in others, it is limited to the winter months because the ground must be frozen before it will support logging equipment. In tropical regions, harvesting is often limited to the dry season as the ground is saturated with water during the rains.

The length of the harvesting season is very important. Where the season is short more men and equipment will be required for any given level of production and road construction. In addition, the shorter the logging season the greater the amount of logs that must be in storage to support the plant during the off-season.

Climate can have other effects. Extreme climatic conditions such as great heat or excessive rain can adversely affect the productivity of men and equipment even when they do not entirely prevent logging.

Climate can, then, affect both capital and operating costs of a log harvesting enterprise.

3.5 Infrastructure

The infrastructure which has been developed in or adjacent to the forest area must also be considered in forest planning as it, too, can affect both the capital and the time required to initiate production.

The most obvious consideration is the extent to which roads, railroads and water facilities already exist and can be used in log transportation and hence reduce the need for new construction. Perhaps less obvious but equally important are the incidence and location of the following:

- Population centres
- Power and communication facilities
- Repair and maintenance
- Spare parts depots
- Contracting organizations
- Vocational training institutes
- Schools, hospitals, markets or shopping centres and other amenities.

Not only the presence of these facilities but also the extent to which they are already committed and their ability to expand must be considered.

3.6 Workers and staff

The availability of suitable manpower is of great importance in developing an enterprise. Centres of population within or adjacent to the forest region can provide either the necessary manpower and/or the housing and amenities necessary to recruit manpower from elsewhere. If housing is not available, it is most likely that it will have to be provided as part of the development programme.

Not only the availability of manpower but also the level of education and the nature of the skills of the labour force must be considered. Forest harvesting requires men skilled in a variety of occupations. If appropriately skilled men are not available, they must be trained. Where suitable training institutes do not exist or are inadequate, they must be provided as part of the development programme. It should be noted that recruitment and training of skilled workers and staff can be difficult and time-consuming, particularly in regions where the projected enterprise represents a substantial increase in forest activity. Recruiting and training programmes must be initiated well before sustained production is required. Many pioneering ventures have found it necessary to employ skilled workers and experienced managers and supervisors from other regions or other countries until local personnel have been adequately trained.

Wage rates or salaries and social benefits customary in the region (or in the region of recruitment) will influence those to be applied in a new project and so will have a direct bearing on production costs. The number of holidays a year and the hours of work each day will affect the productivity of both men and equipment.

3.7 Laws, regulations and customs

Development of any enterprise may be affected by laws, regulations and customs covering a wide variety of subjects. Some of these may be common to many regions; others may be peculiar to the particular region in which the development takes place. Of those most frequently found to affect forest development, some have already been discussed (social benefits, holidays and hours of work, for example); others include the following:

- Forest use regulations
- Environmental restraints
- Government dues for timber cutting
- Scaling and grading rules
- Road use regulations and road use fees
- Waterway use regulations and fees
- Railway freight rates and other charges
- Taxes on fuel, oil and lubricants
- Duties and taxes on equipment
- Import restrictions on equipment
- Development incentives.

3.8 Equipment performance, productivity, cost and availability

Planning a forest harvesting operation requires a thorough knowledge of equipment performance, productivity, cost and availability. The term "equipment" includes machines used for logging, road construction, log transportation and all the various phases of forest harvesting. It also includes the equipment needed to service the production machines.

For most machines, the capacity, horsepower, speed, etc. are readily determinable from manufacturers' catalogues and other sources. For some, estimates of the time the machine will be out of service for repair and maintenance and of the useful life of the machine under specific conditions are also available. Studies may show the productivity (m^3 of logs per day, for example) for some machines under certain conditions. It is very difficult, however, to translate these data into the production rate and the service life of the equipment under the specific conditions of terrain, timber and manpower skill for a particular project and to differentiate among the various makes and models. Yet machines must be selected and estimates must be made as productivity and durability of equipment are major factors in both capital and operating costs.

There is no sure formula to ensure the selection of equipment which will yield the lowest overall cost. Indeed as new types and models of machines are constantly being developed, there is no final answer. Equipment selection will remain a problem throughout the life of the project. The best solution is to place the responsibility for machine selection on men thoroughly experienced in forest harvesting and machine use.

Machine cost includes the suppliers' price plus all the additions (freight, insurance, duty, etc.) necessary to get the machine to the site. Availability is the time required before the machine can be at the site and in service, including manufacturing time, shipping time, customs clearance, etc.

4. PRE-OPERATIONAL PLANNING

Many of the analyses and decisions which must be made to formulate a wood supply plan must also be made to test the feasibility of the project. Frequently, then, much of the planning discussed below will have been initiated during the feasibility stage of the project and need only be reviewed for the wood supply plan. The major difference is that the latter must specify the time at which various activities must commence to ensure an adequate supply of wood for the mill from the day it begins to operate.

Although in this section each phase of the plan is discussed separately, it must be realized that virtually no decision can be reached in isolation - each phase in harvesting affects, and is affected by, each succeeding phase.

At this point it may be beneficial to reiterate that planners of a forest harvesting operation must be well-trained and experienced. There are no magic rules or formulae which will determine the "best" system or the "best" equipment for a particular situation. To obtain the best results, firms or agencies thoroughly experienced in forest harvesting frequently engage specialist consultants to assist them with feasibility studies and initial project planning.

4.1 Selection of the operational area and the harvest volume

4.1.1 The operational area

The general area for wood harvesting will be well identified long before the initial wood supply plan is formulated. For this plan, however, a specific area (or areas) must be designated for initial development and early harvesting. The remaining area is divided into blocks designated for harvesting in subsequent years or decades according to a logical plan. A map showing the timbered areas, the harvesting blocks and existing, planned or projected transportation facilities then becomes an important tool in planning the wood supply.

The area of initial operations is usually selected on timber suitability, ease of access and good logging possibilities to provide wood at low cost for the early years of mill operation. Subsequent road development should be considered to provide access to more remote or more difficult areas so that production can be planned to average high-cost and low-cost areas and provide flexibility to adjust to market conditions.

Where there is more than one forest allocated for harvesting, forest management regulations may require concurrent harvesting in two or more areas.

4.1.2 The harvest volume

When a forest industrial plant stands alone, the volume to be harvested each year is equal to the planned mill consumption. Where other sources of wood are available or where other markets for logs can be found, the harvest volume may vary substantially from the planned consumption. The harvest volume, however, is the figure of greatest significance in planning the forest operation. Harvest volume is equal to the sum of planned mill consumption and planned log sales less planned wood purchases.

The harvest volume, then, is a measure of the total volume which must be logged and transported each year. By dividing the harvest volume by the expected harvest per unit area, a measure of the area to be logged each year can be obtained. This, in turn, aids in determining the annual road construction programme which will be required.

4.2 Selection of the logging and transportation system

4.2.1 Logging

Virtually all the considerations discussed in the previous section enter into the selection of the logging system and equipment to be used for a particular project.

Most of the alternatives can be easily eliminated. Manual systems are not applicable in high-wage areas and animal systems are applicable only where suitable animals can be reared and where there are men willing to train and to care for them. Skidders are not likely to be satisfactory in steep terrain nor cable systems on flat lands. Light cable cranes are not satisfactory where the timber is large and heavy and where long logs must be produced. Sophisticated machinery is unlikely to be satisfactory where maintenance facilities and trained maintenance specialists are scarce or where technological development is at an early stage.

Yet there will still remain a substantial number of alternatives after all the obvious ones have been eliminated. No practical amount of testing and experimentation will clearly differentiate between these remaining alternatives. As a result, different systems have become established in the forest regions of the world and even within the same forest regions, under generally similar operating conditions. It is quite probable that, after all the various factors have been given full consideration, the final choice will depend on the judgement and experience of the planning team. The wider their experience, the better their judgment will be.

After the system has been chosen, there will still remain a wide choice in the makes and models of the equipment which can be used in the system. In making their final choice, planners should give particular attention to the performance history of the equipment and to the nature and location of service facilities and spare parts depots.

New types and models of logging equipment are being developed every year and sometimes extravagant claims are made for them. Only established operations can afford to experiment with an untried machine by testing a single unit and gradually replacing older types when the new type has proved itself. A new enterprise purchasing a full complement of equipment at one time cannot afford to gamble but should purchase only equipment which has been well proved in service.

Mechanized equipment for felling and for log-making is used in some of the high-wage regions of the world. Crosscut saws and other hand-tools continue to be used in some other areas. However, the power chainsaw is used for felling, trimming and log-making at the stump in most operations throughout the world and is the most likely choice for these activities in any new project.

4.2.2 Transportation

Selection of the transportation system, whether it is water, railroad, or some combination, is usually quite simple. Where navigable waterways exist, their use for log transport is relatively inexpensive, particularly for long distances. Water transport methods may include free-floating, rafting and towing, or barging, depending on the nature of the wood and of the waterway together with the regulations which govern waterway use. However, even where waterways are used as the main avenues of transport, quite frequently logs must be brought to the waterway by truck.

At one time railways were built solely to transport logs from a landing in the forest to a concentration area or from one concentration area to another. Today, however, this form of railway transport has been all but abandoned because road transport has been found to be more flexible and less expensive. Public railways may in some circumstances form an attractive part of a transport chain, usually with a truck feeder system.

Where opportunities exist both for the use of water or railways as part of the transportation chain and for road transport throughout, the choice must be based on cost, including all the costs of transferring logs from truck to rail or truck to water. Seasonal limitations on water transport and frequency of the rail service must also be considered.

Most forest harvesting operations will rely to a greater or lesser degree on road transportation. Hence there is a vast array of equipment available. Trucks may range in capacity from five to 50 tons or more; load lengths from about 4 m to 14 m (with trailer); and configurations from simple flat-decks to trucks and trailers equipped with spring-loaded stakes. Log loading may be by human or animal power or by winch and gin pole, power crane, heel-boom loader, or fork lift equipped with log grapple. The trucks themselves may be equipped with knuckle-boom loaders or other loading devices. Each type of truck and loader may be satisfactory in specific situations but, like logging equipment, very unsatisfactory in others. Timber, terrain, logging methods, road standards, road use regulations, log length specifications, log weight and haul distance, all influence the type of equipment which should be used. The loading method must be considered as part of the transportation system. For example, loading by hand or with animals might give the lowest loading cost but could increase the overall cost of transportation by reducing truck productivity because of the time required to load.

As with logging equipment, performance history and accessibility of service facilities and spare parts depots should be given full consideration in the selection of makes and models of transportation equipment.

4.3 Equipment and construction requirements

Once the harvest volume and the logging and transportation systems have been decided, it is a comparatively simple matter to determine the quantities of each type of equipment which will be needed to produce the required volume.

Where suitable contractors are available, they may be engaged to carry out some of the harvesting operations and thus reduce the quantity of equipment which must be purchased. In this way the initial capital expenditure for equipment may be reduced.

It is not enough, however, simply to issue contracts and to assume that they will be carried out. The wood supply manager must assure himself that the contractor is technically and financially capable of performing and he must monitor performance throughout the term of the contract. Any shortfall in contracted production must be made up by wood from other sources - usually increased logging by the harvesting division of the project.

4.3.1 Logging equipment

Once he has determined the harvest volume, an experienced planner can calculate the number of machines of each class which will be required by using the expected annual production of each machine. In his estimate of annual production he must give due consideration to the length of the logging season; the number of operating hours in each day; timber,

terrain and climatic conditions which affect crew and machine performance, setting-up and moving time for each machine, estimated time losses for repairs and maintenance and the training and experience of the labour force.

4.3.2 Transportation equipment

Transportation equipment requirements can be calculated in a somewhat similar manner.

With road transportation, the critical considerations are the volumes which can be carried in each load and the time which is required for loading, delivery, unloading and return for another load, in other words, the cycle times. Considerations in determining cycle times include road quality, loading method, unloading method and average speed of the vehicle loaded and unloaded.

The number of loaders required will depend on loading time and on the distribution of the loading points. That is, it may be possible for one loader to service more than one loading point nearby but impracticable where they are remote from one another. Loaders seldom operate at theoretical capacity unless there is a large number of vehicles hauling from a log assembly area. The limited space available for landings usually prevents storing large volumes at a single location in the forest.

Railway transportation also depends on cycle times of the wagons. In most cases, wagons are supplied by the railway, so their purchase does not enter the wood supply plan. Nevertheless, for an efficient transportation programme an adequate supply must be available. A shortage of wagons may be sufficient reason to rule out railway transportation, even where other factors are favourable.

Where tugs and barges or tugs and rafts are used for transportation, capacity and cycle time will again govern the equipment requirements. Rafting may also require special supplies like boomsticks, boomchains and bundling wires, as well as specific installations - log dumps and dumping machines and raft assembly areas. Barging will require log storage areas on the shore and barge mooring and loading facilities. Rail transportation will require log storage areas at the railway as well as sidings for storing wagons and loading logs.

Plans for all these facilities must be completed as part of the pre-operational planning process.

4.3.3 Construction

Road construction activity will vary greatly from project to project depending on the extent to which the forests are served by existing roads and on the spacing required for the selected logging system.

Accurate estimates of the initial and annual amount of road construction must be prepared very early in the project. It may be necessary to build access roads and main development roads, as well as operational roads in the forest, before harvesting can commence. Once sufficient roads to provide access and to permit flexibility in operational planning have been constructed, the annual road construction programme can be regulated to develop forest land at about the same rate as it is being harvested. Thus the level of road construction is often highest in the very early stages of a project, levelling down to a more or less constant rate in subsequent years.

In most regions of the world, roads are constantly being built for many purposes so that agencies which build roads under contract are quite common. As much use as practicable should be made of these agencies,

particularly in the early stages of a project when more than the usual construction programme is required. However, there is a danger in relying too heavily on others to build forest roads; contracting agencies may be fully occupied elsewhere when the roads need to be built. Consequently, a large forest harvesting project nearly always needs road construction equipment of its own. Depending on the terrain and topography, this equipment may include bulldozers, excavators, trucks, ballast rollers, rocks drills, rock crushers, bridge-building equipment and many other items. Additional equipment including graders will be required to maintain the roads after they have been built.

Very careful judgement must be exercised by the planners in specifying the types and quantities of road equipment to avoid excessive capital expenditure, but at the same time to ensure that sufficient equipment is available to carry out all the construction that is necessary.

It should be noted that, while the construction of roads can often be contracted to other agencies, it is seldom satisfactory to rely on others to determine their locations and standards. Roads are generally constructed to provide a means of transportation between two communities or two points as directly and as cheaply as possible. Forest roads, however, even though they may eventually connect the same two points, must be located to complement the yarding or skidding system and to serve the entire forest area. As logs are usually carried in one direction only, particular attention must be paid to limiting adverse grades. Whenever possible road location work should be carried out by the staff of the harvesting organization or by forest road specialists.

Initial forest development will frequently involve construction of houses, offices, workshops and other facilities. As much reliance as possible should be placed on specialist designers and contractors for such work. Planners for the forest project must ensure that competent contractors are available and that they will carry out the work at a reasonable cost. If competent contractors are not available, it may be necessary to rent or purchase suitable equipment and to hire temporary staff to perform this work.

4.3.4 Repair and maintenance

One of the functions most necessary to ensure an efficient forest harvesting operation is the maintenance and repair of production equipment. Even in regions which are well provided with service facilities, a harvesting operation must have a strong servicing capacity and in areas remote from such facilities, an operation must be virtually self-sufficient. The necessary facilities may range from fuel and lubricant storage for field service vehicles, through small workshops for minor servicing, to large workshops capable of carrying out complete overhauls and even some fabrication.

As much use as possible should be made of the facilities already existing in the region. Planners specializing in the repair and maintenance function should assess these existing facilities and determine the extent to which the harvesting project should augment them. The plan should include provision of sufficient fuel and lubricants, operating supplies, and spare parts to sustain the project until additional deliveries can be expected.

4.3.5 Miscellaneous

In addition to the major equipment discussed above, a great deal of miscellaneous equipment and supplies will be required. Examples include equipment for surveying and engineering, for transport of crew and supervisor, for communications, for office work and accounting, for training, for safety and first aid and for reforestation and fire

protection. All this equipment must be specified and scheduled in the pre-operational plan.

4.4 Manning tables and staff organization

The two major production activities, logging and log transportation, and the major support activities, road construction and equipment maintenance and repair, will require workers in a wide variety of occupations. These range from unskilled labourers to vehicle drivers, power-saw operators, heavy construction workers, up to engineering technicians and skilled mechanics, welders and others. Additional activities such as office work, first aid, reforestation and fire protection require workers with additional skills.

By analysing the production targets and the logging and construction equipment and service facilities already determined, the planners must produce a manning table showing all the various job categories, as well as the number of workers in each category that will be required for the forest harvesting project.

Production workers alone will not ensure an efficient operation. The efficiency of forest harvesting, like that of any enterprise, will depend on how well it is managed. That is, it will depend on how well it is organized, planned, scheduled, supervised, administered and controlled. To carry out these functions, management and supervisory staff must be provided to perform the following tasks:

1. Plan and control logging and log transport;

2. Plan and control the construction and maintenance of transport facilities;

3. Plan and control the maintenance and repair of equipment;

4. Prepare accurate records of past activities and forecasts of the anticipated results of future activities;

5. Control the financial affairs of the enterprise including payment of accounts and payrolls;

6. Coordinate the work of all departments to ensure that corporate goals are met.

Many different forms of operating organizations have been developed to carry out these functions. One very simple system is to have four departments reporting to one general manager, as follows:

1. Logging and transportation under a logging superintendent with further divisions under a felling supervisor, a logging foreman and a transportation supervisor;

2. Engineering, construction and forestry under an engineer with divisions under a forester, a survey crew chief and a road foreman;

3. A workshop under a master mechanic or mechanical superintendent;

4. Administration under a chief accountant or administrative manager.

General Manager

Superintendent logging	Engineer	Master mechanic	Chief accountant

All of these positions may not be necessary in all situations. In very small operations, all the functions can be performed by one or two men. On the other hand, in very large or widely dispersed operations, greater efficiency may be achieved by using area managers, each with an organization of his own and each reporting to a general manager. Where logs are bought and sold, or traded, it may be desirable to add a log grading department under a log grader.

In any new project, the pre-operational planners must select the organization considered to be the most likely to ensure the greatest efficiency for the particular situation.

Wage rates, salary levels and social benefits commensurate with the customs of the region, the responsibilities of the positions and the difficulties of recruiting must be established as part of the pre-operational plan.

4.5 Recruiting, training and purchasing

When the studies and the analyses described in the preceding sections of this paper have been completed, the planners will have defined the manpower and equipment which must be mobilized and the facilities which must be constructed before logs can be delivered to the conversion plant. To ensure that wood will be available on the start-up date, men must be recruited and trained, equipment must be purchased and roads and buildings must be constructed; all these activities must commence long before the start-up date.

Planners must prepare estimates of the time which will be required first to recruit and then to train the required personnel. In some cases, it may be necessary to go far afield to obtain trained, experienced men who can then train others recruited locally. Training courses must be prepared and, if necessary, training facilities must be developed. Some categories of workers will be required before others and the time required for training will vary from skill to skill. In all cases, planners must prepare recruiting and training schedules which will ensure that trained men are available as they are needed.

Purchasing will require preparation of tenders and suppliers must be given ample time to prepare their offers. More time will be required to analyse the responses. Sufficient time must be allowed for delivery and even, in some cases, for the manufacture of the equipment. Some machines will be required on site long before others; for example, road equipment will be required well in advance of harvesting machines (although both will be required for the training programme). Roads must be planned and located in the field before they can be built, so surveying and engineering equipment must have an early priority.

As with recruiting and training, purchasing priorities must be established and purchasing schedules worked out to ensure that receipts are on time and in the correct sequence.

4.6 Cost estimates and financial requirements

Capital requirements can be estimated from planned equipment purchases and planned construction programmes using known or estimated unit costs. From the schedule of delivery dates for equipment and from

work programmes for construction, a financial schedule can be prepared showing the times at which capital funds will be required. Similarly, payroll and training costs can be estimated and scheduled from the planned recruiting and training programmes. These schedules will be of great assistance in the financial planning of the enterprise.

Anticipated unit costs of production can be estimated by combining forecast productivity (machine, animal or manual) with manning tables, wage rates, social costs, fuel (or fodder) costs and usage, depreciation, government dues for timber and overhead costs. These estimates not only assist in financial planning but also provide targets for production costs until better targets can be derived through experience.

4.7 Summary

To summarize the sections immediately preceding, the pre-operational plan should do the following:

- define the volume which must be harvested in the initial years;
- delineate specific operating areas for these years;
- delineate the roads and facilities which must be completed before adequate log deliveries can commence;
- include detailed estimates of the funds and the time required for the construction of each road and facility;
- detail all items of equipment required, their anticipated cost and the time required to obtain delivery and prepare them for use;
- detail all service facilities and spare parts required and the time necessary to obtain them;
- project staff requirements (management, operations, repair and maintenance, etc.) and estimate the training requirement for each trade or skill;
- detail the facilities and the time required to carry out the training;
- provide a schedule showing when each activity (recruiting, training, timber investigation, purchasing, engineering, construction, etc.) must commence in order to meet targeted dates for wood delivery;
- detail capital costs and working capital requirements for the project initiation and the first operating year.

5. OPERATIONAL PLANNING

This paper has concentrated heavily on those aspects of planning which are concerned with ensuring a wood supply to a new conversion plant. There are, of course, many other considerations in planning a forest harvesting operation. The most important of these include careful attention to protection of the environment and to maintenance of forest productivity. All production planning should be guided by the objectives and conditions laid down in the forest management plan for the forest concerned. If such a plan does not exist, one should be prepared before harvesting commences.

In addition, for any forest harvesting operation there should be a master plan to ensure that long-term considerations are not lost sight of in making short-term decisions. At a minimum, the plan should include provision for the main road system within the forest and for progressive development consistent with the forest management plan and with economic harvesting.

Planning must be a continuous process and plans must be flexible enough to permit changes in the conversion programme or other markets. Generally, specific operating plans should be made for two to three years in advance with more generalized planning projected well into the future. A well-planned, well-managed harvesting operation is just as important to the success of a forest industrial enterprise as a well-planned, well-managed conversion plant.

6. CONCLUSIONS

In conclusion, it is worthwhile to reiterate the principles which were set down in the introduction of this paper:

1. A forest industrial enterprise must be planned in accordance with the volume, quality and harvesting cost of the available wood supply, as well as with the available markets and technical considerations.

2. Studies and analyses of the forest resource must be made and preliminary plans for forest harvesting (and/or wood purchases) must be completed before decisions on the nature, location and productive capacity of the plant can be finalized.

3. Detailed planning for forest operations, however, cannot be completed until the nature, location and capacity of the plant have been decided upon.

4. As an expensive road network and/or other transport facilities are usually required for forest harvesting, higher wood costs must be expected if plant requirements restrict the harvest to a small portion of the available timber (veneer logs for example).

5. If a conversion plant is to operate efficiently, adequate supplies of raw material must be on hand at all times. Consequently, forest harvesting activities must commence well before start-up and must be sustained at a rate consistent with the needs of the plant.

6. Transportation facilities and an adequate transportation network (usually roads) must be in place before harvesting can commence. Road planning, location and construction must start two years or more before the roads are required for use.

7. Like a conversion plant, a forest harvesting operation must have suitably trained workers to produce and deliver logs and trained, experienced managers to plan, direct and control the operation.

8. As with all industrial enterprises, a forest harvesting operation must have adequate funds to provide for capital expenditures and working capital.

PRODUCTION MANAGEMENT

by

Unto Roine
Ekono Oy

1. GENERAL DEFINITION AND SCOPE

There are no clear definitions of production management or a production manager. In different connections and in different companies they are given quite different meanings. However, this is not important; the main thing is that the production is managed and under control in the way which, in the particular company and in the existing circumstances, leads to the best possible results. In this paper production management refers to activities involving planning, organizing, directing, integrating, controlling and evaluating the entire process of manufacturing goods at the best costs and time in the best quantity, quality and place. Some general aspects of production management will be discussed to show how its scope is determined in different cases.

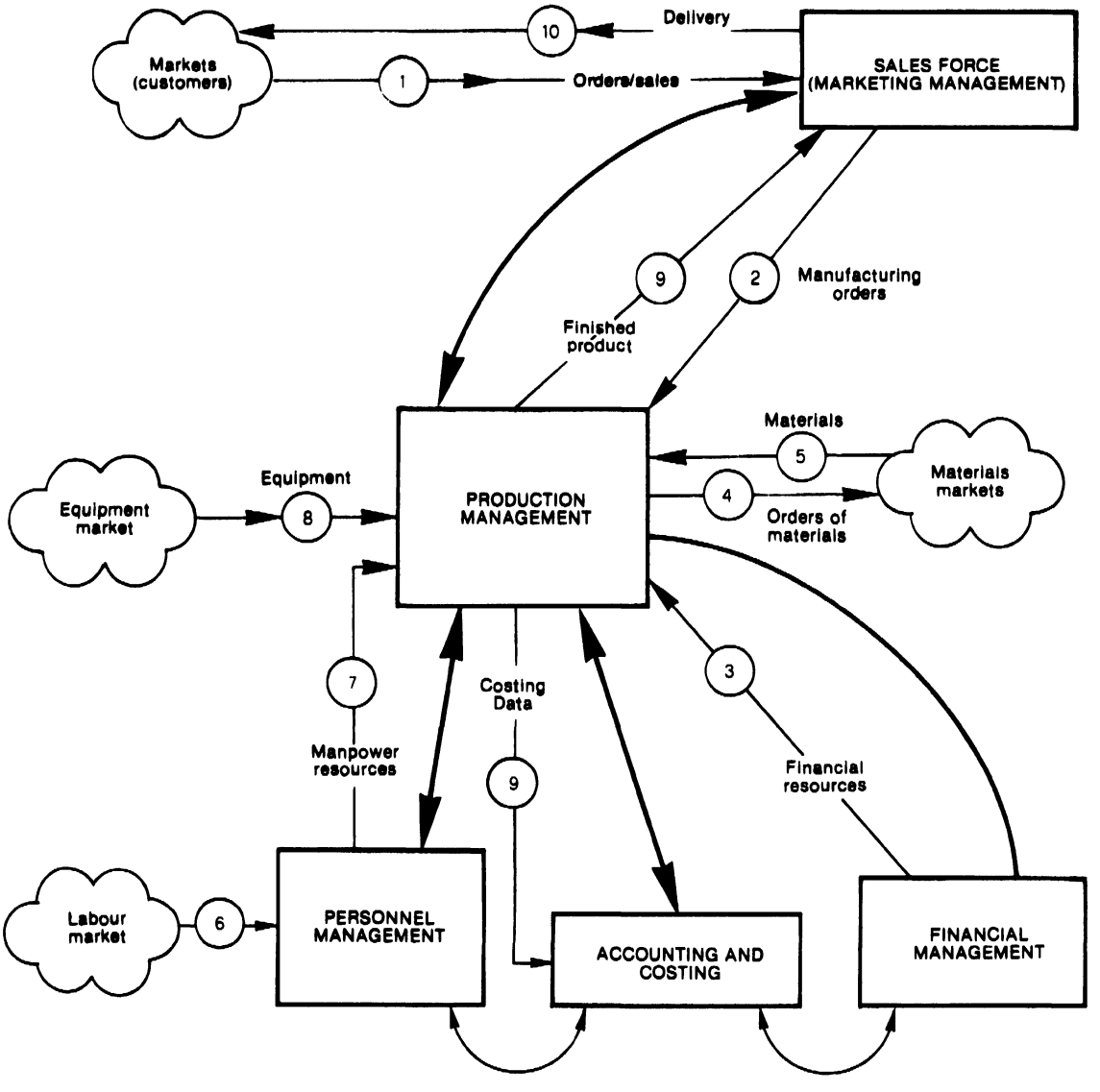
To the manufacturing enterprise production is the basis for operations, the primary objective being to supply the needs of customers with its products.

Production is closely related to and connected with all other functional areas of manufacturing and must never be treated as an independent or isolated activity. These relationships are illustrated in Fig. 1.

The diagram represents real flow and deployment of information, money, material and personnel within the company. The organizational structure of the manufacturing enterprise must ensure that a constant attempt is made to integrate all the production related activities of the various functional areas to attain the goals of the enterprise. These relationships and the flow of resources may also serve as a model in determining the importance of the various functional areas in the manufacturing operations.

Such thinking may lead to a certain amount of conflict, the usual conflict between production and sales staff as to which side dictates what should be produced or sold. This does not occur in small companies where both the production and sales functions are subject to the same direct management. In larger companies it is necessary to separate these functions and conflict becomes almost inevitable.

Who dictates the operations depends largely on the market situation. When there is a so-called buyers' market, the sales people have to have the primary say over production. Generally speaking, in the present global marketing situation there is an oversupply of products and the sales force rule the operations. The wood working industry is no exception. The same relationships between the different functional areas are found, and the size of the company as well as the existing market situation decide the role and contents of production mangement. In any case, production management is always an essential part of developing, planning, implementing, controlling and supervising the production functions of the manufacturing enterprise.



Source: UNIDO Production Management for Small and Medium-Scale Furniture Manufacturing

Fig.1 THE RELATIONSHIP BETWEEN PRODUCTION MANAGEMENT AND OTHER ASPECTS OF THE MANUFACTURING OPERATION

2. PRODUCTION SYSTEMS

2.1 Job order production system

This term describes the method by which contracts for single articles are handled in manufacture. The products are tailor-made to the specific requirements of buyers. This production system has not been applied in the woodbased panel or the sawmilling industries.

2.2 Batch production system

This system may be defined as the manufacture of a product in small or large batches or lots, by a series of operations, each operation being carried out on the whole batch before any subsequent operation is started. This system is very uncommon in the woodbased panel or sawmilling industries. However it is applied sometimes when the production is highly specialized, e.g. there are sawmills for special lengths and specifications of sawn goods.

Batch production is based on customers' orders and started by buying the most suitable logs for the required specification. The logs are cut to fixed lengths and sawn to desired dimensions. This kind of production is very customer orientated and close cooperation between sales and production is essential. Effective production planning is complicated and usually this production system can be applied only to small or medium sized manufacturing units where it is common that sales and production management are together in one unit.

2.3 Flow production system

Flow production methods of organizing work apply to those factories where practically all operations have to be undertaken continuously without breaks. Woodbased panel and sawngoods production are good examples of this system. They have the same flow production characteristics. These are outlined below:

- rigid product specification;
- raw material supplies and quality, an essential part of production planning;
- highly specialized machines and equipment laid out in a line formation for production;
- a production run on the same type of product for as long as possible;
- supervisor(s) trained in high-standard production techniques;
- a system of production control based upon the rate of flow through the production process;
- strict arrangements to ensure that materials arrive neither faster nor slower than at this specified rate;
- "crash" methods to overcome any blockage in the flow of production materials;
- importance of preventive maintenance to minimize the downtime of the production line;
- often a complete cessation of work while production equipment is rearranged in sequence to suit a new size or quality;
- use of conveyor systems to handle materials through the process;

- a daily and shift-end check on production output at each key point in the production process and a regular inventory of materials in hand.

3. PRODUCTION MANAGEMENT ORGANIZATION AND RESPONSIBILITIES

The production management organization and its responsibiliies vary a great deal. They depend on many factors, for example, the size of the company and the mill, the industrial sector, the type of process and the organizational structure which is used in the company.

3.1 The size of the enterprise

The responsibilities of production management vary greatly according to the size of the company and the size of the mill. In the woodbased panel and sawmilling industries a mill with a turnover of over US$ 20 million per annum may be called a large one, from US$ 5-20 million medium-sized, and below US$ 5 million a small one.

Although many functions and demands for services are similar in the plants of small and large companies, production management in small companies usually operates with little or no staff, whereas in large companies many staff specialists and experts take part in the operations. Therefore, the primary difference of responsibilities in small and large companies will be in the diversified knowledge that the production management must possess.

Without specialists to handle quality control, labour and community relations, air and water pollution problems, cost control, inventory, scheduling, distribution, maintenance, engineering, technical services, research and development, accounting, safety and security, wage and salary administration, packaging and transportation, the production manager of a small mill in a small company must be an executive who enjoys getting out into the mill to solve problems and give directions personally. He must therefore have a high degree of capability in all activities and he uses most of his time in the mill solving problems. Operations in such a mill are usually conducted on the basis of its short-term profitability. The manager does not have much time for reports or for sophisticated operating methods. For him the important task is to get jobs done as easily, quickly and cost-effectively as he can.

In a small company the production management will of necessity operate with minimal staff. The manager himself will be on call 24 hours a day, at week-ends and on holidays. A telephone must always be close at hand because he will receive middle of the night calls about equipment failures, process problems, fires, accidents, and strikes. He cannot add staff to assist in problem solving. Staff is an overhead, which eats into the profits.

The scope of objectives and responsibilities and the work itself are different in a large company. Whereas communications in a small company are informal, mainly oral, reporting in a large company is complicated. The production management manages the operations by figures and reports on a daily and monthly basis which are produced by cost control, quality control, and production departments. The production management's freedom to make decisions is limited by company policies, strategic plans and directives from head office. Production management will get assistance from special staff on such matters as cost control, planning, development, personnel, purchasing and maintenance.

In a large company, the production management must spend a lot of time away from the factory floor. Planning, budgeting, all kinds of reports and constant meetings occupy much time. In a large company the need for controls and control systems is inevitable.

It is difficult to say which is more effective, a small company or a large one. It may be said that in a small company production management covers more of the activities and gets less specialist assistance or management tools than in a large company; therefore, their task is more difficult. On the other hand, it is also more interesting and could be more effective because of greater freedom and flexibility in decision making and more influence on the profitability of the operation.

Companies and mills are constantly developing, growing and changing their business ideas, and production management has to follow the changes in organization and responsibilities accordingly.

3.2 The production process

There are some characteristic differences in hardboard, chipboard, plywood and sawmill production management. These variations are based on different cost structures, continuity of the process, and variety of products.

The production process in fibreboard and chipboard manufacture is continuous. Production is easily disturbed by many breaks in machinery whether short or long. The many automatic controls are sensitive. The capital investment is large and therefore the fixed costs, depreciation and interest costs, are high. Start-up takes time and is costly. For economic reasons, production must be in three shifts and even continue over the week-ends if possible. The sales margin should be checked per production hour and not only per m^3 produced. In this type of production the problems are very often technical and the production management must be technically highly trained. The key areas in production management are:

Fibreboard:

- Production volume. To minimize downtime is most important, and special attention should be paid to preventive maintenance.

- Raw materials. Wood as raw material covers about half of the direct production costs. The most economic raw-material mix is the key to low production costs.

- Energy. The energy costs are about 30 percent of the direct production costs. Special attention should be paid to checking the energy consumption and price and developing energy conservation programmes.

- Process control. The quality of the product depends on process control. This will become increasingly automated.

- Pollution. Water pollution problems have already closed several mills.

Chipboard:

- The key areas are very similar to fibreboard. As an exception there are no water pollution problems. Wood raw material and energy are slightly less important cost factors.

- Glue. Glue costs are about 30 per cent of the direct production costs. An accurate process control on the amount of glue and on particle geometry is essential. This is also the most vital point in controlling the quality and strength of the board.

Plywood:

- The production process for plywood is continuous, but the machinery is not connected into one line. Production is therefore to some extent flexible. It flows from one machine or machine group to another. In between, there are intermediate stocks of veneer and plywood in progress.

  The productivity, production volume and direct production costs depend heavily on labour, how skilled they are and how motivated they are to work efficiently. The workers also control the quality, and faults are usually caused by human errors. The technical function of the machinery is not as important as the process itself. The properties of raw material and glues and knowledge about the peeling, drying, glueing and sanding processes are essential for problem solving in manufacturing.

  In the plymill there are plenty of workers. Human relationships are important and friction between people and working groups can cause serious production problems. On the other hand, the production system allows plenty of possibilities to solve problems and to make decisions. In a plymill, production management needs good knowledge about management itself and leadership capability.

  The key areas are:

- Labour. As a cost factor it is about 25 percent of the total direct production cost. Skill and motivation are important. Incentive schemes in the wage policy are recommended.

- Raw material. This represents more than half of direct production cost. The quality of wood will determine the output of product grades. Yield control is essential for cost-effective production.

- Production planning. This is complicated because of variations in the quality of raw material and because of the large numbers of grade, thickness and size combinations of plywood panels.

Sawn goods:

- Sawn goods production is a continuous process and most of the machinery operates in production lines. The raw material, sawlogs, is the decisive element in production management. The size and quality of the logs determine the lumber output specifications. If sales are not realized accordingly, the results have an adverse effect on yield. Close cooperation between sales and production management is vital to profitability.

  There is a large range in the size of sawmills. The technology of small ones is quite simple, but the larger, modern sawmills are very sophisticated, using automatic process controls and minicomputers. Investment costs for such a mill are high, more than US$ 200/capacity m^3. The profit margin is usually low, and the breakeven point often requires a production volume which can be reached only in a two-shift operation. The key areas in production management are:

- Yield. Raw material covers two-thirds of the total direct production costs. To improve the yield is the primary objective of production management.

- Waste. Bark, sawdust and chips have a great effect on the sales recovery. In Scandinavia they represent more than 20 percent of total sales. Product management has to develop processes to add the value of waste.

- Production planning. This affects the yield, production volume and sales recovery. Profitability can be achieved only by close cooperation between sales and production management.

3.3 Organization

In woodbased panel and sawn goods manufacturing, all the basic organization structures can be applied:

- functional organization
- line organization
- matrix organization.

The commonest is the line organization structure. In this system, the directives and reporting go along clearly defined organization lines from the managing director all the way to the workers. In general, the organization of companies and mills includes elements from all the above-mentioned basic types. There are no general rules about what kind of organization should be applied, but some examples from Finnish industry may illustrate the alternatives used in practice. See Figs. 2-7.

3.4 Responsibilities of production management

It is impossible to give a general description of production management functions and responsibilities which could be applied in every mill, but an example might illustrate this matter.

Plymill production manager - responsibilities:

1. To plan production
2. To put the production plans into operation
3. To assist in the sales
4. To develop the products
5. To develop the machinery and process
6. To maintain the production capacity
7. To take responsibility for personnel and safety
8. To take care of organization and inner and external contacts.

4. PRODUCTION MANAGEMENT IN THE WOODWORKING INDUSTRY

4.1 Planning and development

Planning can - depending on the planning period - be divided into long-range planning, which finally creates a strategy for developing and running the mill, and short-range planning, which takes the form of a budget. It should always be remembered, however, that although the final result may be shown in figures, they describe the final outcome only if the planned actions are carried out and the estimates of conditions have been correct.

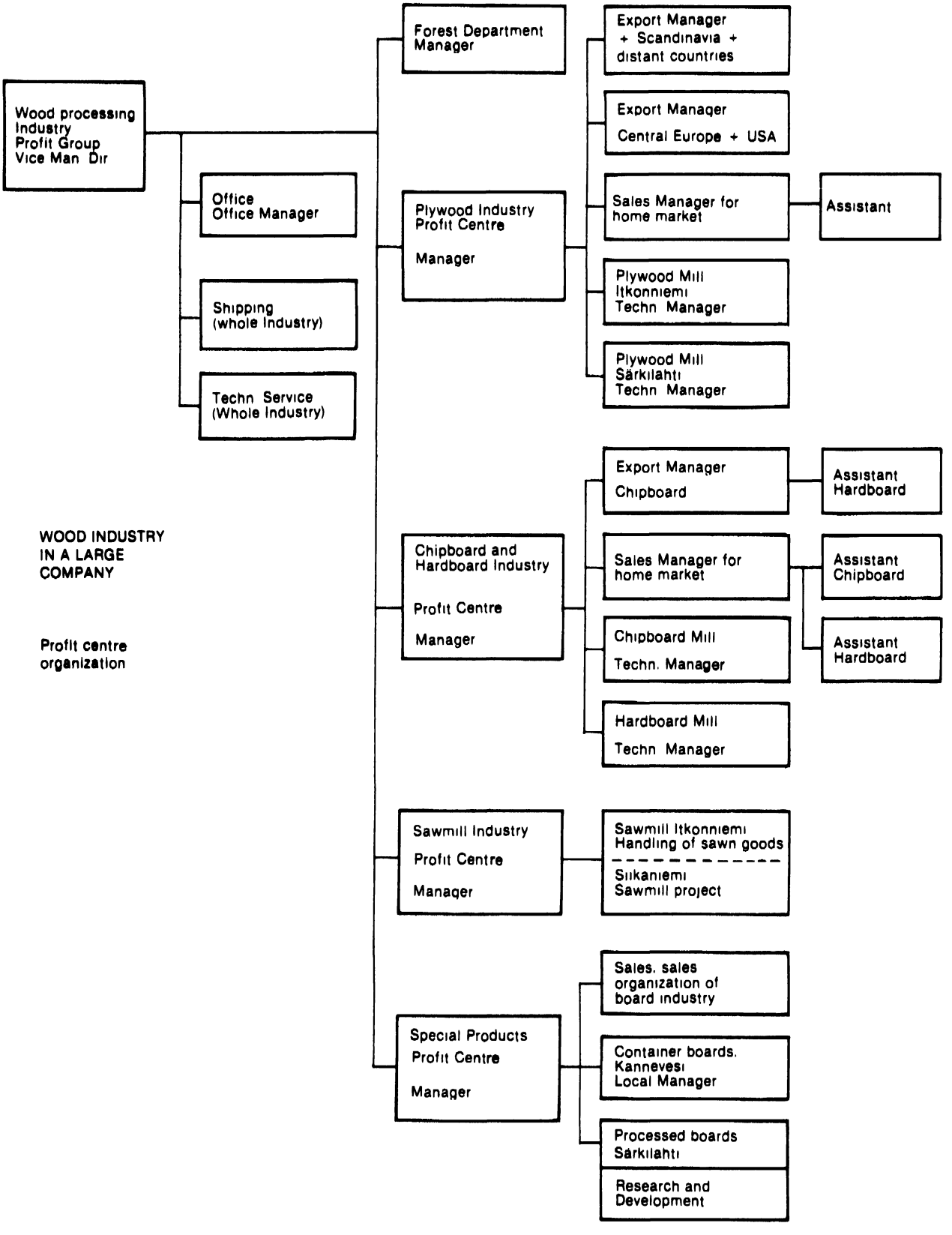


Fig. 2 PROFIT CENTRE ORGANIZATION IN A LARGE FOREST INDUSTRY COMPANY

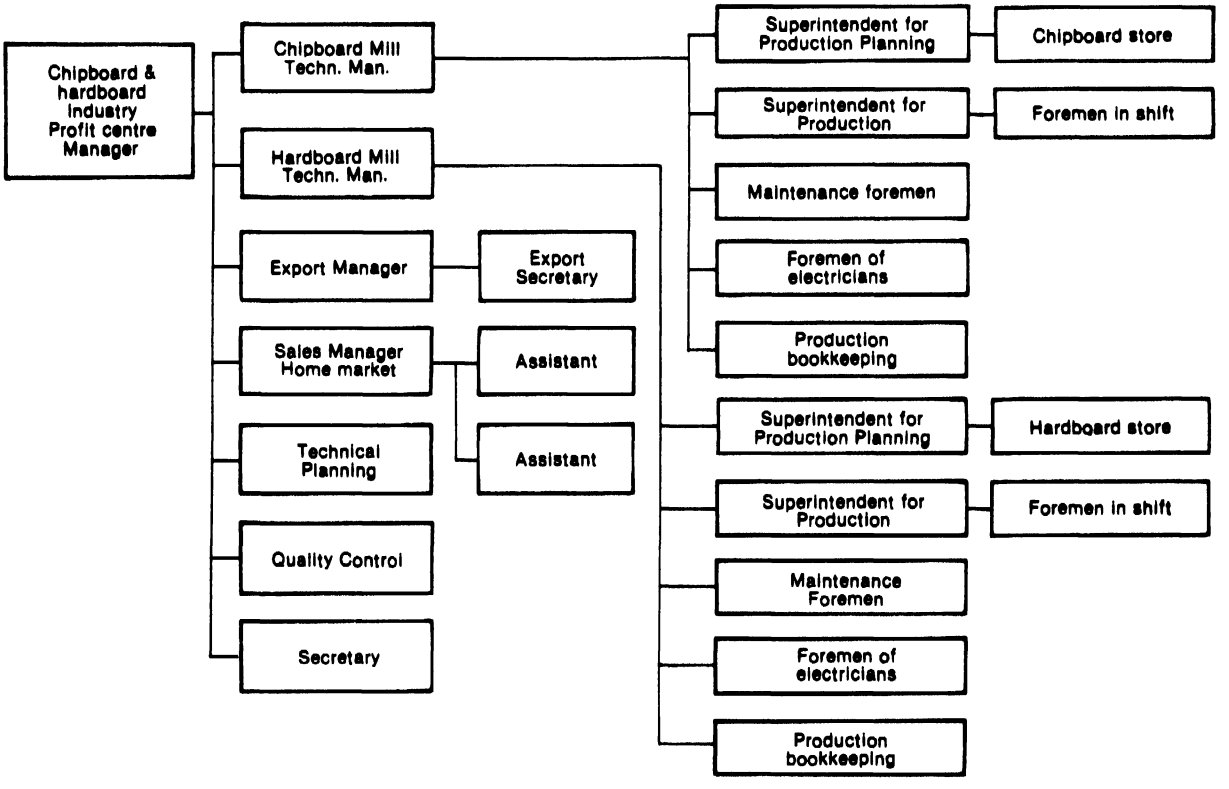


Fig. 3 ORGANIZATION OF A CHIPBOARD MILL

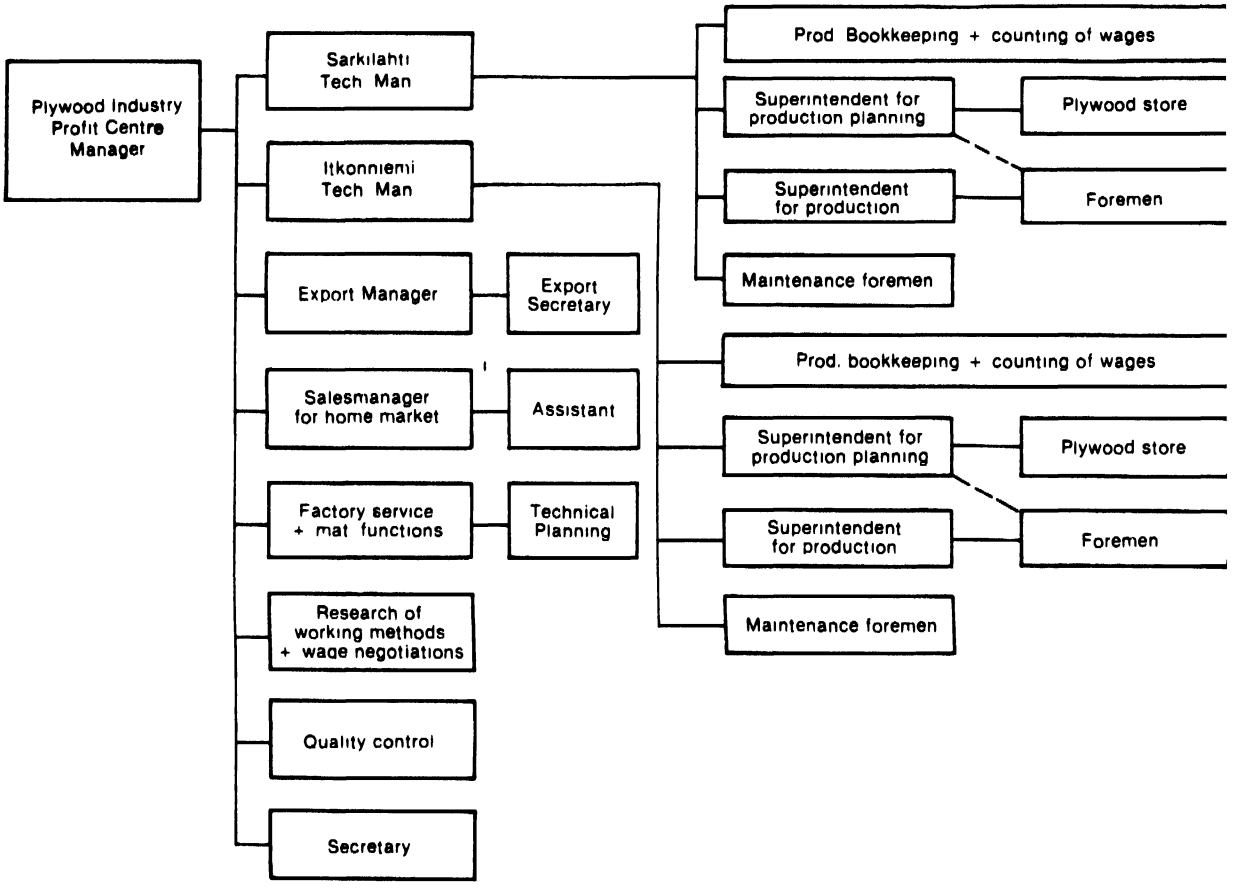


Fig. 4 ORGANIZATION OF A PLYWOOD INDUSTRY

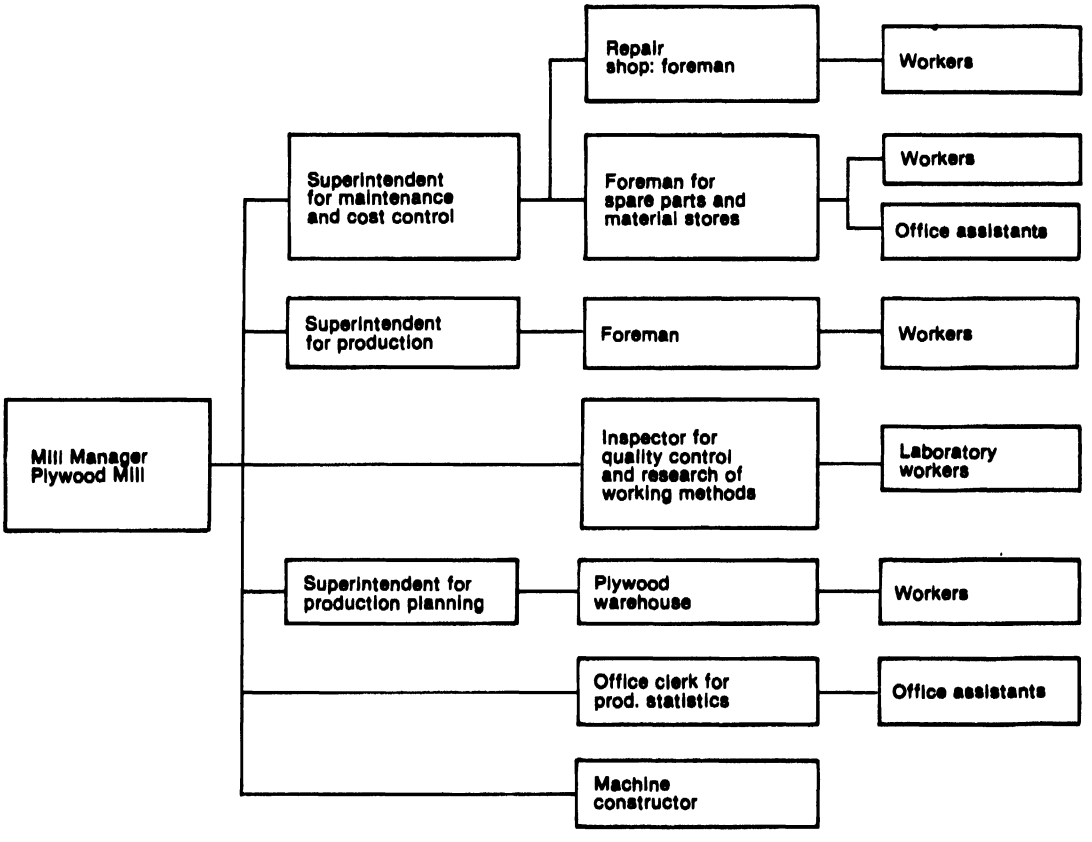


Fig. 5 ORGANIZATION OF A PLYWOOD MILL

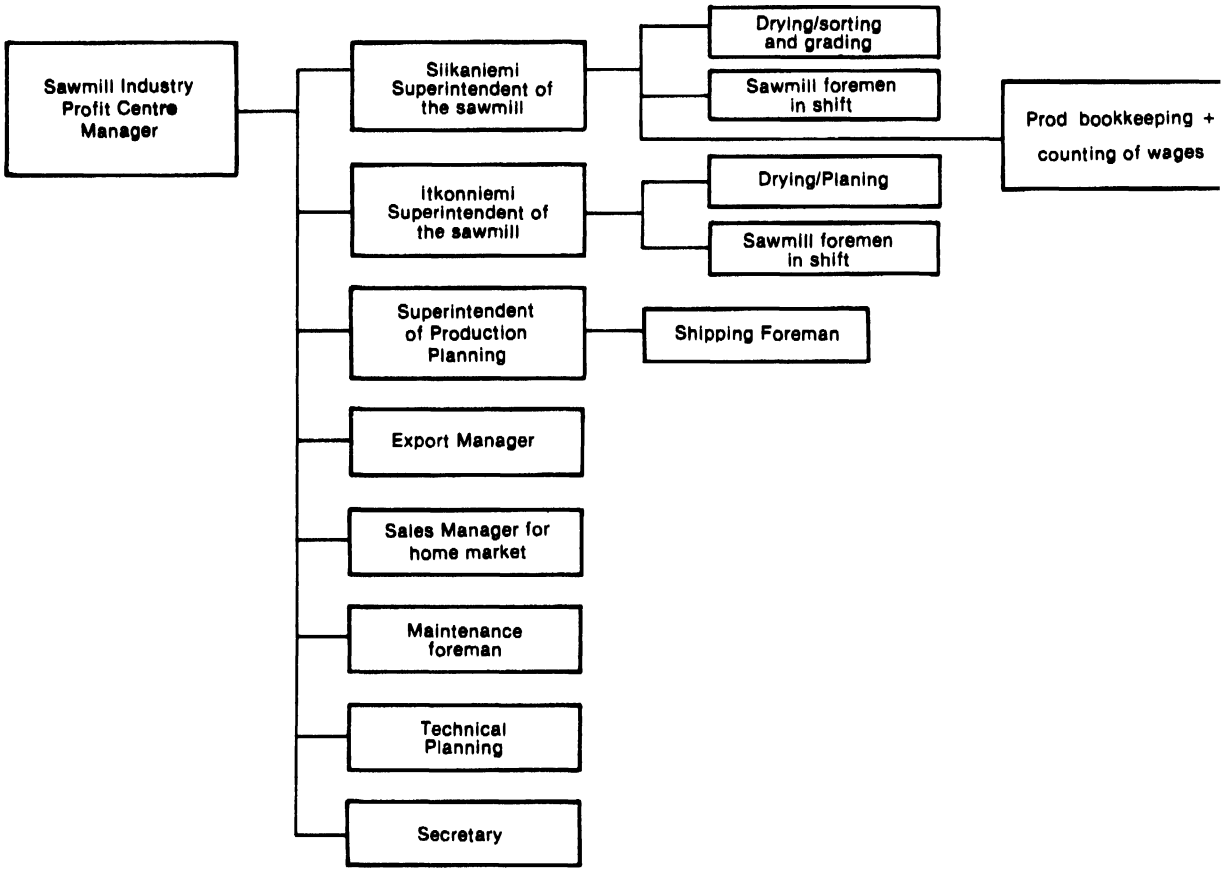


Fig. 6 ORGANIZATION OF A SAWMILL INDUSTRY

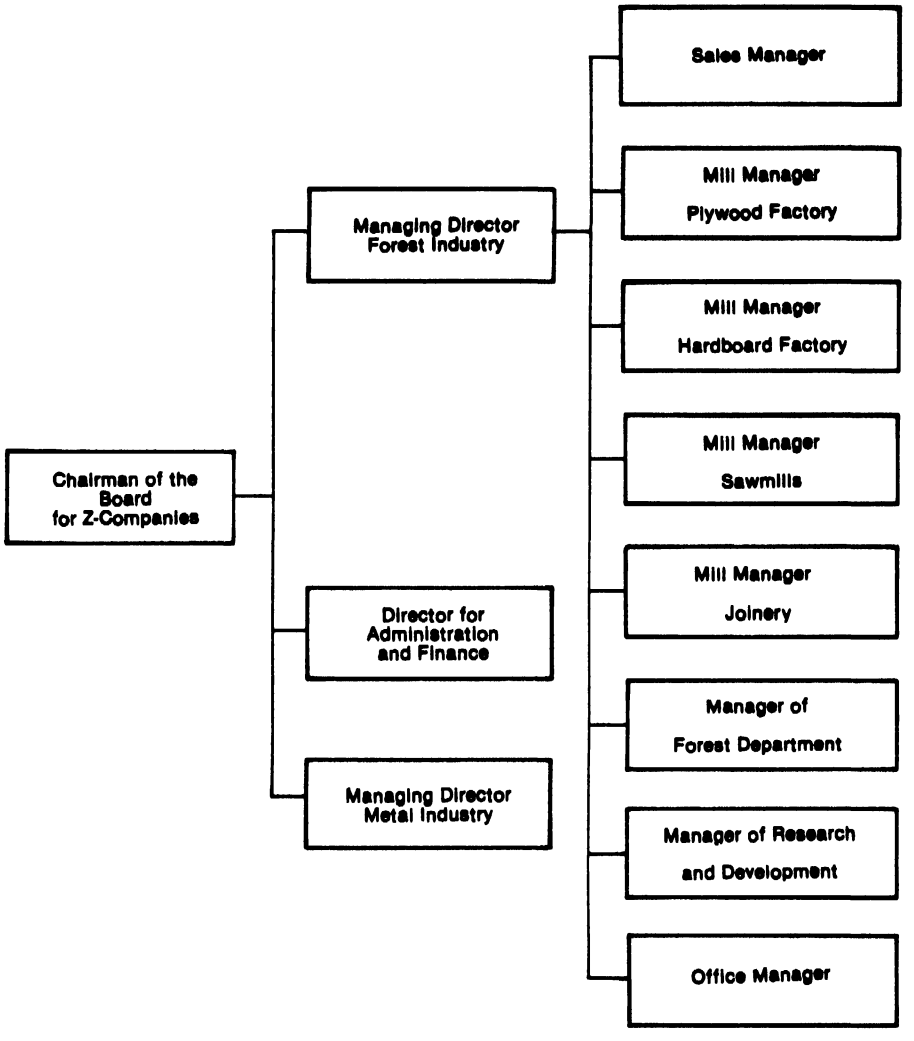


Fig. 7 MANAGEMENT STRUCTURE OF A LARGE FOREST INDUSTRY CORPORATION

Long-range planning is primarily the business of top management. However, production management must participate in the process, considering the strategic goals of the company and the limits of resource allocations given by the company's management. The period of long-range planning varies between five and eight years. In practice, it is useful to show only the first three years in figures in the budget and to illustrate the rest of the period by development programmes.

There are many sophisticated planning methods. One of the best is to use a scenario. In a scenario the situation and external conditions at the end of the planning period are forecast. The details which should be considered in the scenario are as follows:

- what the possibilities of acquiring raw materials will be, with regard to price, quantities and species of wood;
- how the quality and size of raw materials will have changed;

- how the possibilities of acquiring labour and the cost per working hour will have developed;

- what kind of technical innovations are expected;

- what the market situation will be and what kind of requirements the users will have for the product;

- how the product may be transported, packaged and used;

- how legislation, safety precautions at work, and labour union agreements might have changed.

Factors that might threaten the success of the mill and those that will offer new opportunities for development must be reviewed. On the basis of the scenario, it is possible to take realistic action and consider development programmes and alternatives.

In the long run, product development is more important than the development of production techniques or methods. This work must always be done in close cooperation with sales management since the initiatives have to come from the markets - from the end users. Product development concentrates on three main objectives:

- Improvement of production systems so that they can be used for new applications;

- Achieving the best product quality according to existing end-use requirements;

- New products for new end-use areas.

Although long-range planning is important, preparation of the annual budget is a process which is more closely connected with the functions of product management.

The main content of the budget is the annual production plan added to an investment programme, presented in monetary terms and in the form of annual income and cost structure, showing the expected operating results and cash flow.

4.2 Production planning and control

Production planning is the basis for all production operational plans. It also acts as an interphase between the market and the firm's production system, linking the sales and production operations.

There are basically two types of time plans in production planning: an annual one based on the sales forecast, and shorter ones - quarterly, monthly, weekly or daily - based on orders received.

In the plywood and sawmilling industry, production planning is rather complicated because the wood material which is used produces certain amounts of grades irrespective of what is needed on the market. To meet the demand it is sometimes necessary to downgrade a better quality thus losing some of the product's value. Because of the complicated planning process, computer programmes have been developed for sawmills and to some extent also for plymills. Sawmill programmes simulate the production process with a linear computer programme, achieving the optimal breakdown of available logs to meet the specifications of projected demands. Programmes for the plywood industry are used to find the best sales mix, taking into account the limitations of production capacity and the availability of raw material.

If there is a sellers' market, the starting point of production planning is the production capacity, and the sales plan is prepared according to the production plan. Nowadays a buyers' market predominates and production plans have to be based on sales forecasts.

The annual production plan which contains production volumes in grades and sizes is subdivided into months or even shorter periods, and makes the necessary allowances for estimated breakdowns, maintenance and holiday periods. The basic plan is broken down into a number of subplans and objectives:

- Plan for the supply of wood so that it is brought to the mill at the right time, making allowances for seasonal difficulties in logging and transport;
- Process plan determining which machinery or production lines will be used for how many hours and shifts;
- Manning plan for labour and staff, envisaging when and how personnel will be recruited and laid off if changes are expected;
- Purchasing plan for materials and parts;
- Plan for inventory development;
- Plan for company development and investments.

Short-term production planning is based on orders received. The operative sales plan is drawn up for a three to six month period, always according to the prevailing market situation and the production capacity of the mill. The production management checks with the sales department daily on the suitability of declarations, specifications and inquiries, with special regard to delivery possibilities. It also presents its views to the sales department along with possible alternatives.

According to order delivery times, the production management prepares a dispatch programme, usually 4-8 weeks ahead. Detailed daily and weekly production planning is based on this programme. The orders are combined into production runs which are as long as can be managed. A long run reduces production costs, but at the same time increases some delivery times and the amount of inventories.

Production planning gives the manufacturing section detailed daily or weekly instruction and work programmes, e.g. in a plywood mill, a programme for peeling and glueing, as well as instructions for sawing and sorting.

Production figures from every production stage are usually compiled daily by computer into reports, key factors to be used as tools in production control. The same basic information is used for many other purposes, e.g. for calculation of wages, invoicing, economic control.

Some information generally used for production control is given below:

- Received wood volume
- Wood consumption
- Wood inventory
- Production stage 1
- Production stage 2
- Production stage 3
- Production stage 4
- Ready goods
- Dispatch
- Intermediate stocks

- Warehouse inventory
- Material consumption
- Production hours.

Deviations from the production programme are reported.

The reporting system is too slow to cover all control needs but daily control is necessary to follow up on the production of orders.

Fig. 8 illustrates an integrated planning and control system of a Finnish sawmill.

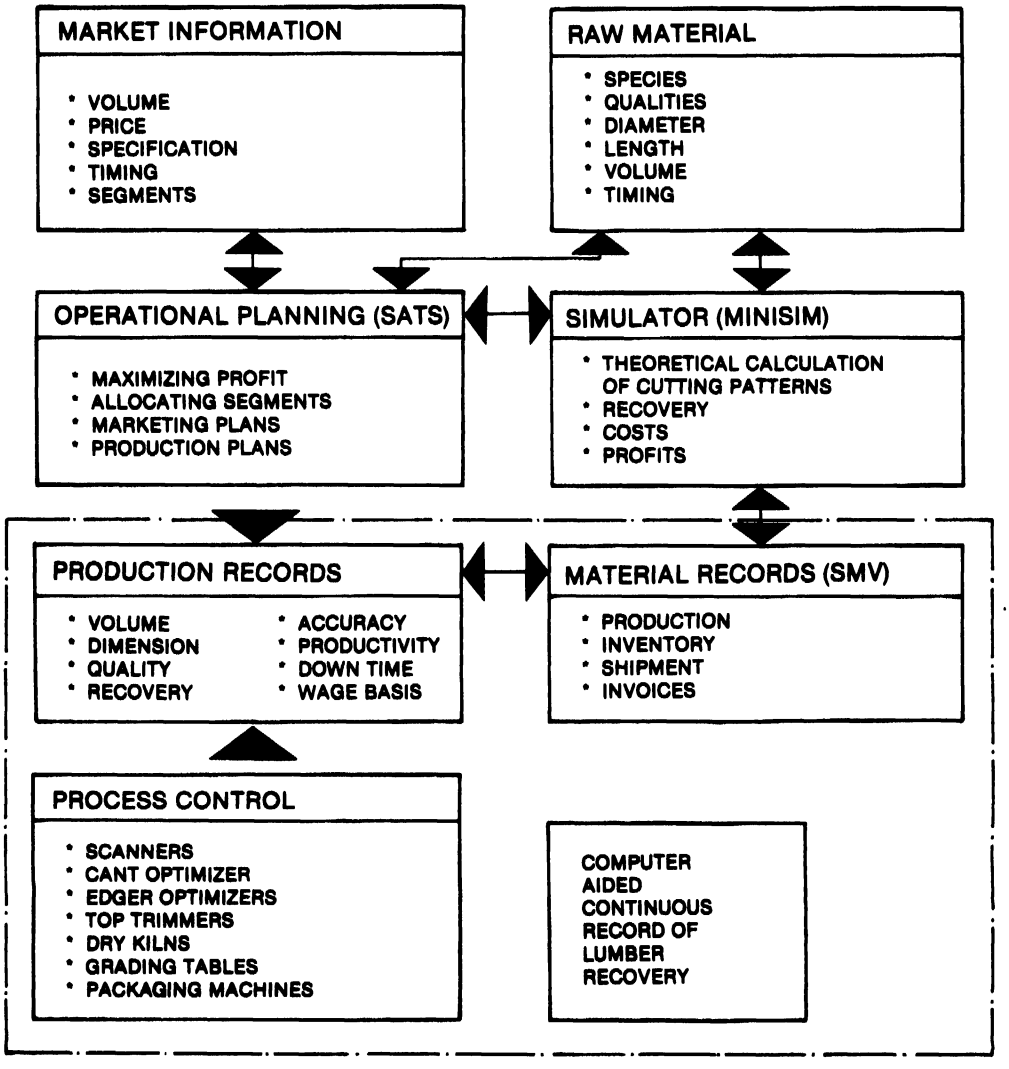


Fig. 8 INTEGRATED PLANNING AND CONTROL SYSTEM OF A FINNISH SAWMILL

4.3 Cost control

The budget is the basic material for cost control. Reports will show deviations from the budget and inform where and how the plans have not been fulfilled. By analysing the deviations, production management will decide on the necessary steps to correct the situation. Some key figures are needed for cost control and analysis of the situation. Examples of the key factors for which figures per production unit (e.g., m^3) are needed are the following:

- Wood consumption
- Materials, e.g. glue
- Manhours
- Heat
- Electric energy
- Chip volume
- Sawdust volume.

When these are reported for different stages of the process, the reasons for deviations may be found.

Other valuable information is the unit prices of materials, average wages, turnover of stocks and inventories, grading results of the products, downtime statistics, and percentage of rejects.

4.4 Quality control

Quality control is based on management decisions on quality policy and determining the desired market level of quality. Accordingly, production management has to decide on the following:

- The standards to be used in the production process and for products;
- The zone of acceptability or tolerance in each critical part;
- Points throughout the process where materials, components and products need to be checked;
- Methods of control;
- Checklists and checking tools at every point in the process where checks are needed;
- Quality control organization and the reporting system;
- Implementation and correction whenever necessary.

Standards and tolerances are decided according to official standards, commercial practice, suppliers of materials, instructions, and experience of the manufacturing process.

Checkpoints for process control are established either before the critical part of the process or after it, to ensure that the product is of the required quality. As an example, the most important checkpoints in the chipboard manufacturing process are as follows:

- Moisture content of green chips
- Moisture content of dry chips
- Particle geometry
- Glue and hardener properties, e.g. viscosity, pH, coagulation time
- Glue dose and proportioning
- Particle proportioning
- Weight of chip mat

- Pressing temperature and time
- Strength properties of board
- Swelling of board
- Moisture content of board
- Free formaldehyde of board
- Dimension tolerances of board.

The methods used for quality control are: human inspection which is used when there is a large number of varieties, or intelligence is needed in classifying the defects, or when standards are difficult to define; automatic inspection, especially when automatic control of the process is desired; statistical methods when changes in the process must be found.

Statistical quality control is based on the fact that if a process is set up properly and is running normally, the individual readings on inspection have approximately the same symmetrical form of distribution around the arithmetical mean. When there is a change in process, either the average figure will move or the spread of the distribution will change. The development of the process can be followed by control charts illustrated in Figs. 9 and 10.

There are also other less scientific methods of statistical quality control, e.g. by grouping and classifying the reject or downtime statistics according to the character of faults or the origin of reasons.

Finally, an inspection system must be set up. At this stage production management should ask questions like "Who is responsible for checking at the first, second and third critical points in the process?", "Who will check the final product?", "How is this information reported and to whom?" and the most important, "How will this information be used?" Once these and similar questions have been satisfactorily answered, the system can be implemented and corrections and adjustments made when and where necessary.

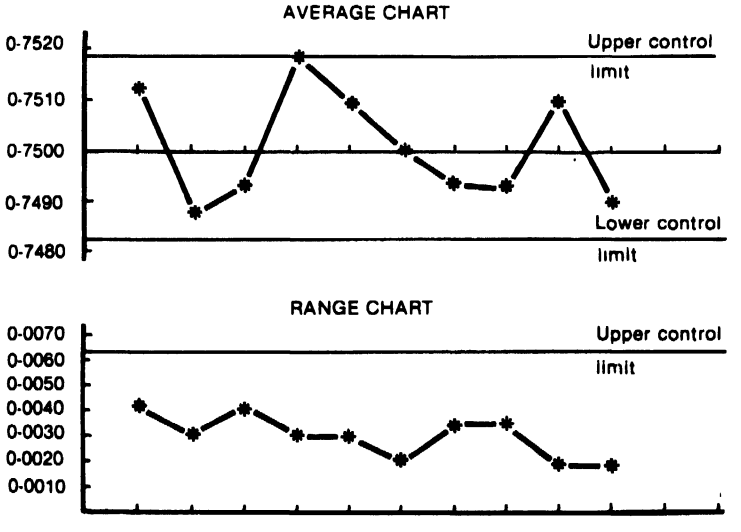


Fig. 9 QUALITY CONTROL CHART
AVERAGE AND RANGE CHART WITH CALCULATION OF LIMITS

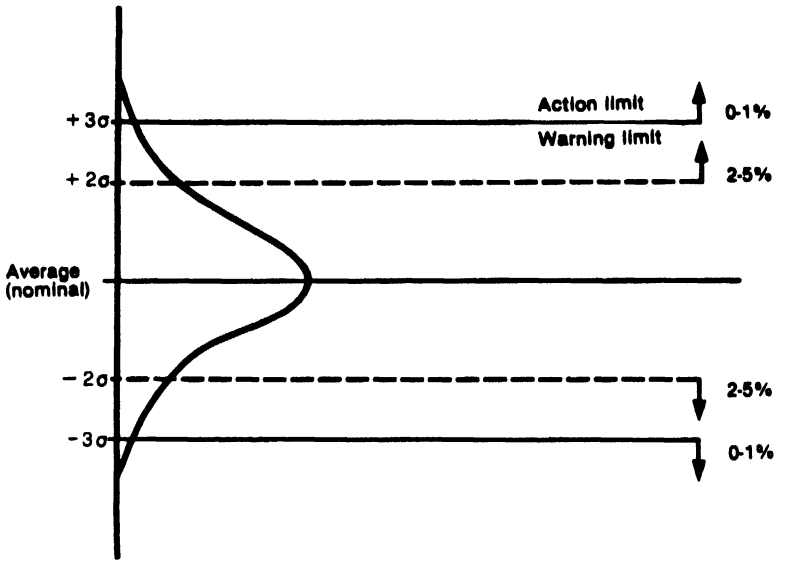


Fig. 10 QUALITY CONTROL CHART - CONTROL CHART FOR AVERAGES

4.5 Purchasing and material control

A particular area of production management involves managing the acquisition, utilization, movement, handling and distribution of various inputs to the manufacturing process. In the woodbased panel and the sawmilling industry, materials planning is a part of production planning, and handling is closely linked to production technology and layout as shown in Fig. 11.

The routine technical work of purchasing is done by a separate purchasing department, but production management nevertheless has to pay attention to purchasing activities by checking and controlling at least the following points:

- prices free delivered at mill;
- product quality suitable for production and in the right relation to price;
- packaging; a suitable size of package can save handling costs and make the delivered volumes more accurate;
- the volume of orders;
- the time of ordering; consider the consumption, delivery times and the need for safety (buffer) stocks.

Special attention has to be paid to the correct size and frequency of purchase orders. Fig. 12 illustrates a way of ensuring this. The cost may decrease with larger lot sizes because of the following:

- procurement of large lots may give a volume rebate;
- speculative buying price policy is possible;
- more favourable terms of payment and transportation costs may be obtained;
- downtime costs resulting from the shortage of material are likely to be reduced.

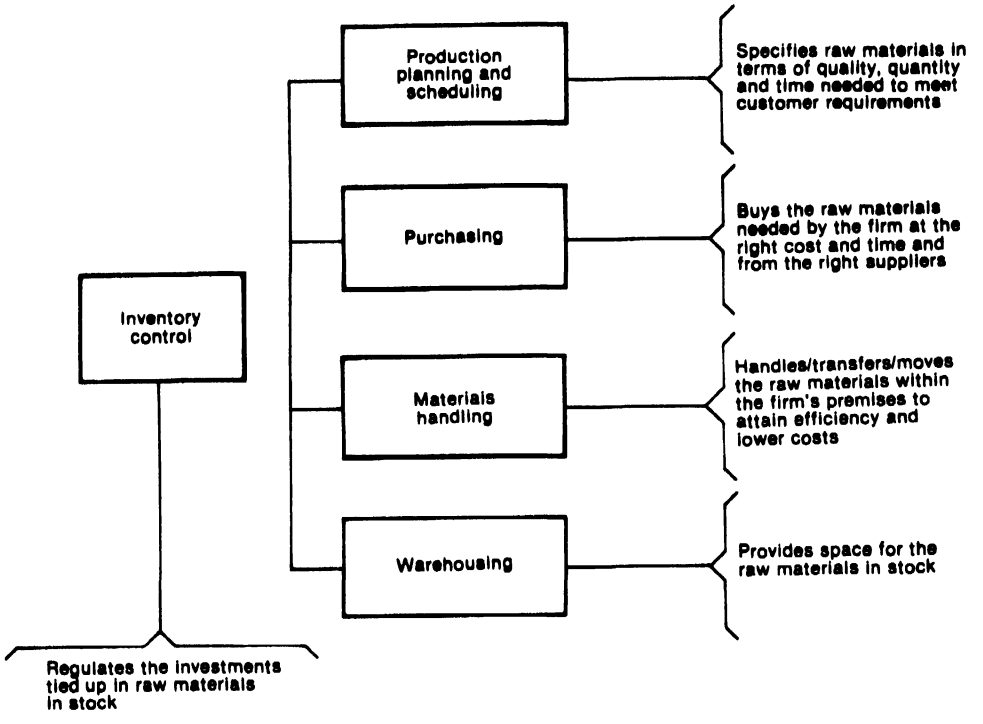


Fig. 11 SCOPE OF MATERIAL MANAGEMENT

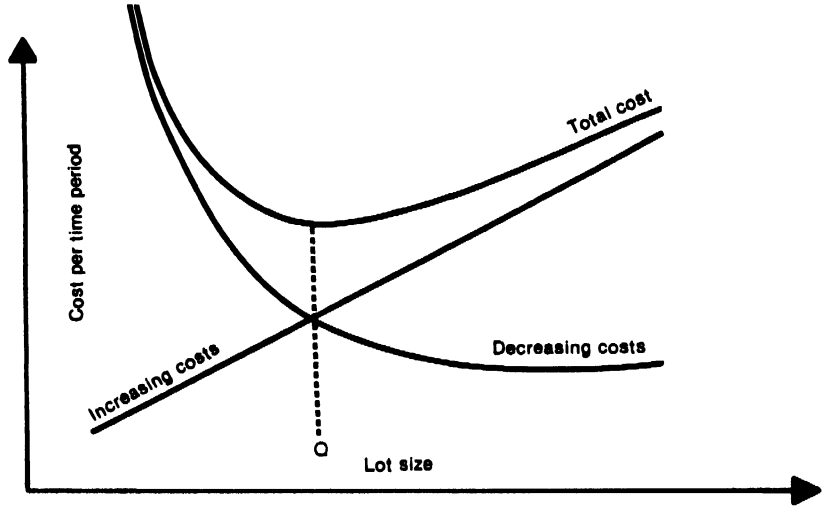


Fig. 12 COST PATTERNS GENERATED BY VARIATIONS IN THE LOT SIZE

The cost increases in regard to lot size when the following occur:

- the inventories grow and interest costs grow accordingly;
- warehouse costs, costs of premises and handling costs are higher;
- there is a build-up of old stock.

It is important to decide where the stocks are to be stored. A centralized warehouse is not always the most cost-effective place. Handling and internal transport can be reduced by storing stocks near the place where they will be used.

The most important purchasing activity in the wood processing industry is the procurement of wood raw material.

In sawmilling and plywood industries, where the quality of logs is decisive even for grades of end products, the purchasing of logs is of vital importance. Usually, a separate forest department takes care of this activity. Good cooperation between management and this department is essential. Some of the factors vital to both are:

- The delivery programme and safety and buffer stocks;
- Cutting instructions for stems;
- Quality requirements and information on desired dimensions.

Another important aspect of materials control is the regulation of the financial resources tied up in stocks. For this an inventory control system is needed which will cover not only materials and finished products, but also the work in progress. This information is needed to do the following:

- calculate the operating result of the mill;
- provide information for production planning;
- keep the stocks at an optimal level, compromising between the need to minimize working capital and to prevent stopping production or creating production runs which are too short;
- enable delivery times to meet sales;
- decide upon and regulate purchase orders.

To fulfil these objectives, the inventory control should provide information about the following:

- volume in stock for each item;
- unit price x volume = value of inventory;
- volume divided by consumption per month, giving the turnover of the stock. Consumption per month is calculated from reported consumption per product unit (e.g., m^3) and from monthly production plans.

4.6 Labour and staff

Irrespective of the technological level of the mill, its planning, control and other management systems, the production volume, the quality level and the success of the operations depend on human performance, the skill and motivation of people. Production management has to take care of these leadership functions.

The main actions which production management must take to improve the skill of personnel are as follows:

- Recruiting the right calibre of people. Selectivity is possible only if there is a pool of qualified applicants from whom to choose. The job and environment should be attractive to applicants. Information is collected to screen applicants and in some cases they may be tested for suitability;
- Not only newly hired labour and staff but also existing personnel should be trained to improve their knowledge of new developments.

To create good motivation, attention should be paid to the following:

- matching the man to the job. (Nevertheless, some job rotation is recommended even in cases where the man is quite capable in his present job);

- improving human relations by the right kind of supervision, by developing a correct and clear organizational structure and considering the need for job satisfaction;

- avoiding an unpleasant and unsafe work environment;

- using incentive schemes whenever possible. These are applicable especially in the following circumstances:

  . when performance depends on the man's own efficiency and skill;
  . when the process does not change;
  . when performance can easily be measured at the end of each shift.

If all the above conditions are not fulfilled, it is still possible to use an incentive scheme which represents a minor share of the total wage or salary.

The management of people is very important when the production process is labour-intensive and operations depend to a great extent on the skill and efforts of labour. A typical example of this kind of industry is plywood manufacturing.

4.7 Cooperation with the sales management

The basic function of a manufacturing enterprise is to satisfy some needs of consumers or end-users. Sales management has the closest contact with consumers and the best opportunity to know what is needed and how needs may change in the future.

Production management cannot succeed in developing production without cooperating with the sales management. On the other hand, the sales management can hardly succeed without knowledge of present and future production possibilities. Product development and product policy are the areas where cooperation is vital.

Production management and sales management must coordinate the production and sales plans together. Quantities, qualities and dimensions have to meet raw material and production restrictions. Good cooperation is essential in order to maximize the contribution of the production side.

Production management should participate actively in the sales of the products; the end-user needs information about the technical characteristics for different applications and production management are obviously the best people to solve any problems.

Production management assists daily sales management by reporting possible delivery times and alternatives to be offered, and by calculating quotations for special offers.

They are responsible for quality and for completing orders on time. If something goes wrong, production management is deeply involved in settling the claims.

4.8 Cooperation with maintenance management

Maintenance work can be organized under a centralized department or decentralized into production departments. Wherever it is practicable, decentralization has proved to make operations more flexible, quicker and more effective, resulting in lower maintenance costs and reduced downtime in production. Centralized maintenance departments usually include only a general machine shop, in which machine parts which are needed can be made. Maintenance work is either breakdown maintenance which is carried out after a failure, but for which advance provision in the form of spares and labour should have been made, or preventive maintenance which is directed to preventing failure of a facility.

The effect of downtime costs shows how important preventive maintenance is. If a machine in a production line breaks down, the entire line will be shut down, resulting in high idle-labour costs and lost production. Therefore the preventive maintenance programme is most important in the fibreboard, chipboard and sawmilling industries.

The main ways for production and maintenance to cooperate are as follows:

- to find the best means of minimizing downtime losses, preventive maintenance costs and breakdown repair costs;
- to plan a running maintenance programme which can be carried out while the facility is in service;
- to determine and plan the shut-down maintenance times;
- to decide on the priorities in breakdown emergencies.

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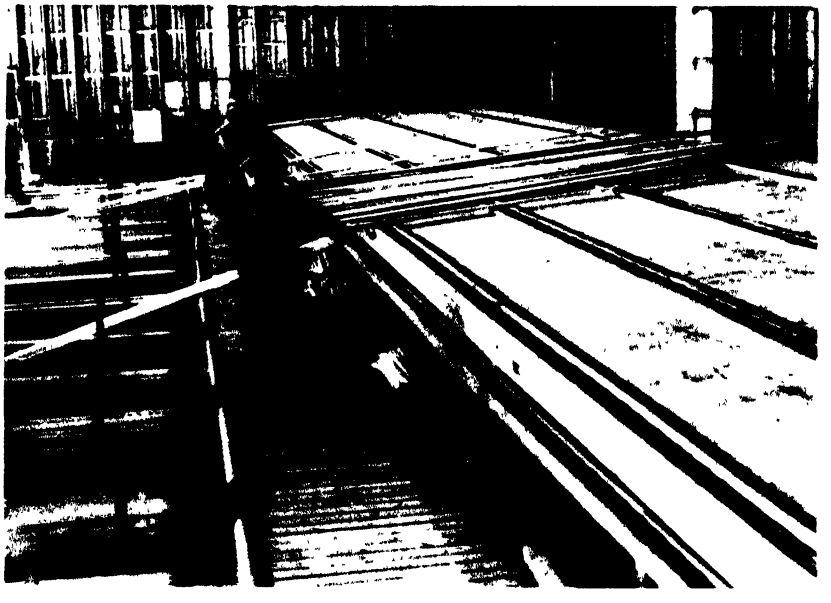
Grading of dry boards (Photo: H. Seppanen)



Sorting lumber in the Vapo sawmill at Mikkeli
(Photo: H. Seppanen)

MAINTENANCE MANAGEMENT

by

Matti Väkeväinen
Enso-Gutzeit Oy

1. FUNCTIONS AND RESPONSIBILITIES

1.1 Concepts

To understand mill maintenance functions it is important that the concepts involved are clear. In this paper such concepts, as well as the functions themselves, are discussed.

1.1.1 Maintenance

Maintenance is an organized function. It involves the preparation of the mechanical repairshop, electrical, instrument, and construction shops. Their purpose is to maintain a production plant and its machines, equipment, buildings and grounds in the best functional condition in order to achieve the greatest operational stability as defined by the management of the enterprise, at the least cost.

1.1.2 Maintenance service

Maintenance service is in a broad sense a "side job function" used to obtain the above-mentioned goals.

Depending on the factory, the following may be part-functions of a maintenance service department:

- maintenance
- work planning
- maintenance planning
- mill security
- transport
- mill stores
- general planning.

1.2 Fields of activity

The maintenance services' field of activity generally comprises the factory area as a whole and possibly the residential area (with buildings) in the vicinity of the factory.

1.3 Goals

The overall goal of maintenance is to pursue a strategy of reliability and service that will keep costs during the planned operation period to a minimum.

This goal may be served by the following means:

1. Minimizing production breaks by maintaining machines and equipment at planned intervals and selecting the proper objects for maintenance;

2. Maintaining machines and equipment in such running condition that the correct production quality is maintained and drawing up the maintenance plans so that machine and equipment life will be extended;

3. Making efforts to keep maintenance costs equal in different periods.

1.4 Planning and organization

Maintenance planning and organizing, as parts of enterprise functions, signify the creation of a maintenance policy. It is essential to recognize that maintenance is not a separate function. Its planning and organizing should start at the investment stage because it is then that a certain standard of maintenance will be set and several decisive conditions for the quality of maintenance to be carried out in the future will be created. Goals defined at a later date can be realistic only if this initial position is noted.

The planning and organizing of maintenance systems is a strategy applied on the basis of the policy created to achieve the set goals.

It should be mentioned that the planning and organization of maintenance are not separate and internal. They should be connected with the external and environmental factors of the enterprise.

1.4.1 Function and readiness to act

An acceptable maintenance function may be either active or passive. The former includes primarily prevention and improvement, the latter repairs.

Both forms are needed in correct proportions. This ratio will be discussed later on.

1.4.2 Organization

The so-called maintenance service branches like transport, mill stores, planning and purchasing, are important in the chain of maintenance functions and should be recognized as belonging to the area of maintenance responsibility.

Normally, this is taken care of by placing maintenance and maintenance service branches under the same management. Depending on the size of the plant, either a maintenance service management is required or maintenance comes directly under plant management.

As an entity, the organizational structure should correspond to the requirements of the goals (not needs) and be flexible.

When an organizational model is selected it should be remembered that a "best model" which could fit every enterprise does not exist. The maintenance organization model is affected by the following factors, among others:

(a) The size of the (industrial) plant;
(b) The location of departments in the factory;
(c) Operational efficiency;
(d) The available resources - amount and quality;
(e) How maintenance is distributed among the mechanical, electrical, instrument and construction departments;
(f) The ratio between active and passive functions;
(g) The availability of outside services.

Three different organization models are introduced below:

- Centralized;
- Decentralized;
- A combination of the two.

Centralized organization

This type is centralized both administratively and geographically. In other words, the maintenance organization is directly under the management of the enterprise and its services are ordered direct from the central repair shop. The maintenance services department may also form a profit centre of its own. Examples are shown in Figs. 1 and 2.

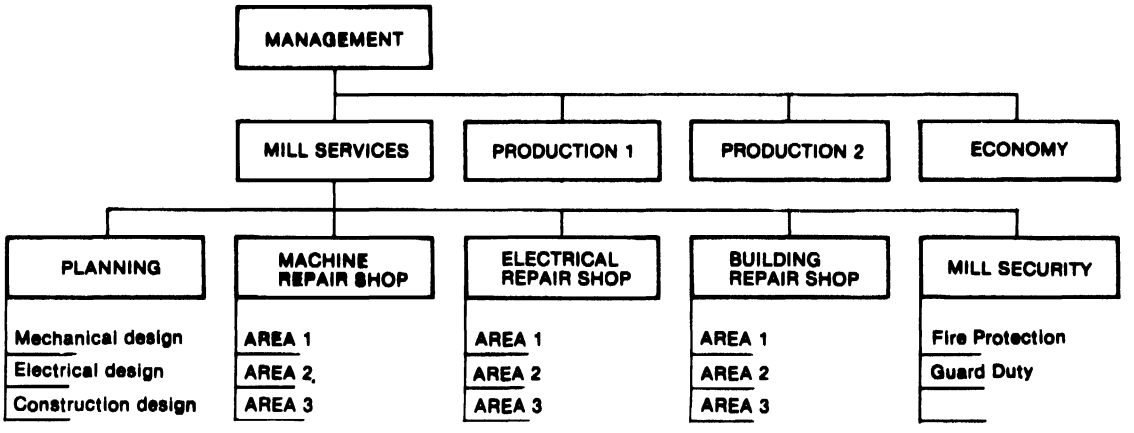


Fig. 1 ADMINISTRATIVELY CENTRALIZED ORGANIZATION

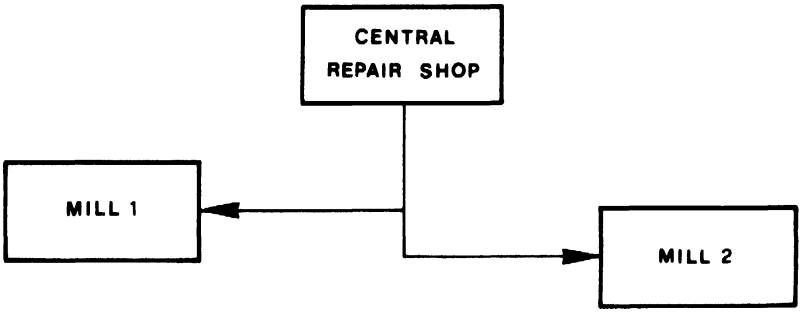


Fig. 2 GEOGRAPHICALLY CENTRALIZED ORGANIZATION

Decentralized organization

A decentralized organization is broken up both administratively and geographically. It is composed of maintenance departments under the production and plant service departments.

Geographically, the shops are connected to different mill departments and function under the management of the production organization. Examples are shown in Figs. 3 and 4.

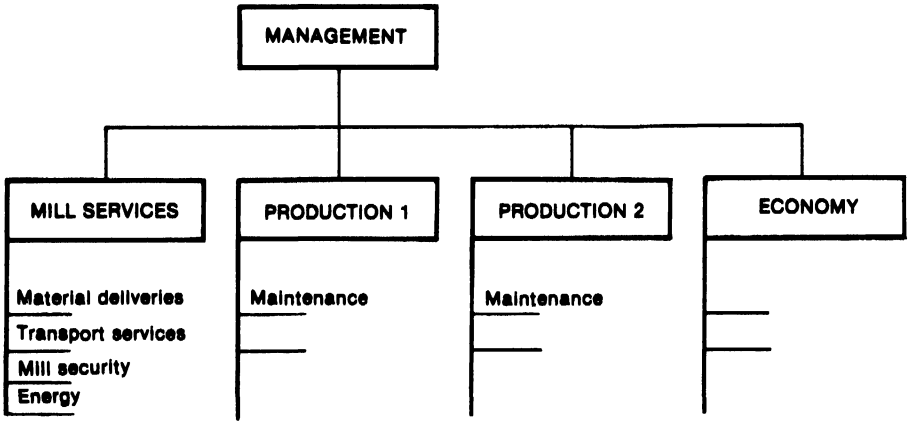


Fig. 3 ADMINISTRATIVELY DECENTRALIZED ORGANIZATION

INDEPENDENT REPAIR SHOPS OPERATE IN MILL DEPARTMENTS

Fig. 4 GEOGRAPHICALLY DECENTRALIZED

Combination organization

Administratively centralized and geographically decentralized organizations have been selected as examples (see Figs. 5 and 6). The maintenance organization is administratively placed under the management of the enterprise and only special services are available from the central repair shop.

The shops, located in mill departments, function independently under the common maintenance management.

1.5 Responsibilities for maintenance

Responsibility for the immediate goals of production, like quantity and quality, is nowadays increasingly centralized under competent production specialists. It has been found that as a consequence the services needed directly or indirectly by production have been transferred to maintenance to handle. In other words, the goals of an industrial plant dictate the form of organization which is best able to perform each task.

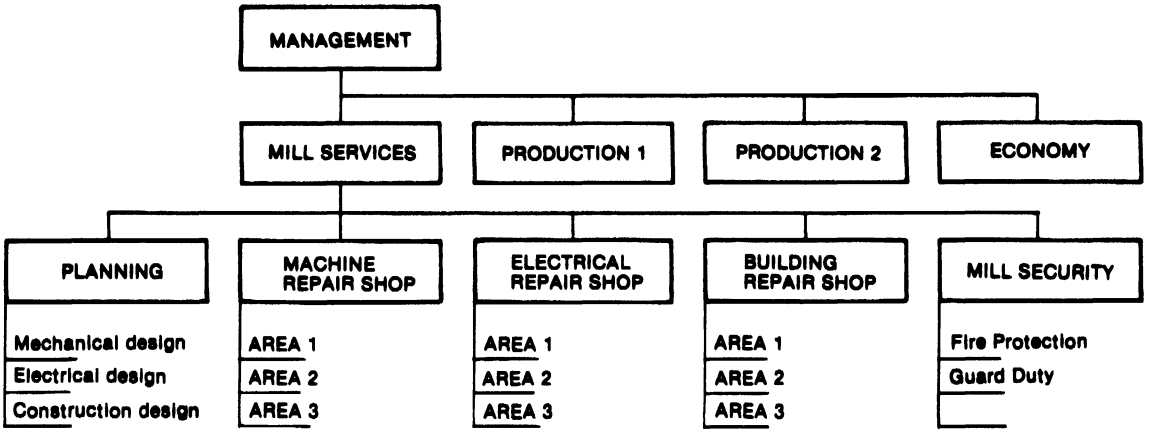


Fig. 5 ADMINISTRATIVELY CENTRALIZED ORGANIZATION

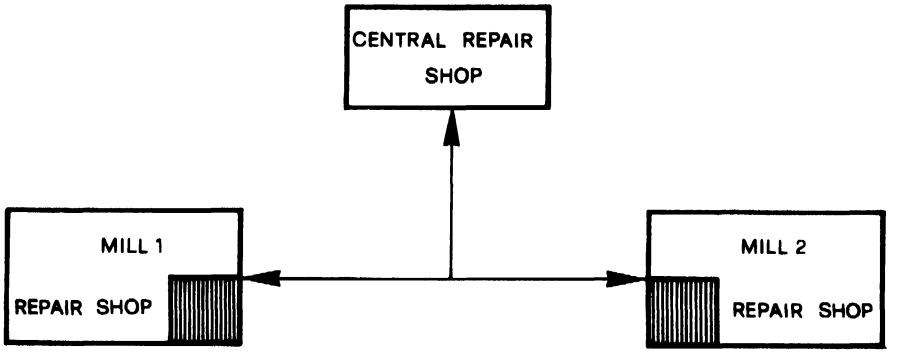


Fig. 6 GEOGRAPHICALLY DECENTRALIZED ORGANIZATION

Thus the significance of maintenance as a part function of an industrial plant has grown strongly and is still growing. This increases the responsibilities which have been laid upon the maintenance department. It should be added that if the maintenance personnel are to be responsible for the continuous good performance of machines and equipment, the production departments should call on the experience of the maintenance department when they are bought.

The maintainability of the machines is determined by the time they are planned for.

The main responsibilities of the maintenance department may be as follows:

(a) Maintaining machines, equipment, buildings and factory areas in functional condition to ensure production and continuity of other operations without any production losses;

(b) Keeping their own organization and personnel operational and instructing machine operators in maintenance;

(c) Improving the quality and programming of maintenance and getting the best results from their work with respect to costs and preventing loss of production;

(d) Informing operating departments about experiences gained during maintenance work;

(e) Being responsible for drawing up and implementing the maintenance budget;

(f) Informing the operating departments of required maintenance and proceeding with pertinent measures;

(g) Before beginning maintenance, making sure that all aspects of mill security (safety) have been considered;

(h) Directing and controlling the activities of outside contractors;

(i) Taking charge of transport, transfer and other services connected with maintenance that has been separately agreed upon;

(j) Participating in the planning and realization of investment plans within the resource limits available;

(k) Participating in the planning and realization of experimental and developmental work.

The above responsibilities are a challenge to the whole maintenance organization. At the same time, these large requirements and the wide field of responsibilities demand that maintenance be given an appropriate status in the organizational structure of the enterprise.

The status of the department may be clarified if the requirements of profitability set for it are considered, because the measures taken by the department may have a significant effect on the operational capability of the whole enterprise.

Operational capability comprises:

- operational reliability
- "maintainability"
- maintenance readiness.

As mentioned before, the operational reliability of machinery and equipment or of an industrial plant can be improved by active maintenance activities and by taking account of maintenance viewpoints as early as the planning and acquisition stages.

"Maintainability" may be kept to a high standard if the maintenance department is always ready to act or, in other words, if it is efficiently organized.

When the organization of maintenance is examined, the goals and responsibilities of many sectors should coincide with the production process and with the operation of the entire plant.

2. PLANNING OF THE MAINTENANCE FUNCTIONS

2.1 Introduction

This introduction is based on experiences gained in the Finnish wood processing industry during the 20 years in which maintenance work has

been planned and organized. Objectives and concepts which motivate these functions are presented below. In principle, these findings are still valid in spite of details which have changed because of the development of computer techniques. On that basis, the organization of maintenance functions has been criticized from time to time, but it can be said that nobody questions the work-planning task itself.

Most of the maintenance department's working time is spent under the influence of the dictum that costs are the fundamental criterion. Likewise the performance of maintenance work often involves the coordination of several factors contributing to quality and quantity. This type of activity does not succeed without planning.

2.2 Concepts

2.2.1 Aim

The task and aim of systematic maintenance planning is to map the amount and kind of maintenance work required.

2.2.2 Planning maintenance work - the aims of the department

- Elimination of wasted time
- Elimination of unnecessary work
- Scheduling the workload of labour
- Better planning of shut-down maintenance
- Improvement of working methods
- Improvement of equipment
- Inspection of the completed work
- The creation of a basis for objective work measurement.

2.2.3 The tasks and actions of the work planning organization

Preliminary action to define and examine work needs

- Checking the correctness of the work order;
- Checking the adequacy of drawings and instructions;
- Agreeing a decision on the quality of the work;
- Planning the workload of the labour;
- Organizing machine cards, machine numbering and machine signs;
- Setting up a card index of spare parts and planning for storage;
- Documenting breakdowns and repairs and maintaining archives of technical documents on machines.

Clarification of the work load

- Determining the kind and amount of work;
- Apportioning work to different maintenance departments (machine, electrical, instrument, etc.);
- Determining hourly work quotas;
- Scheduling the work (desired, possible);
- Writing work orders and forwarding them to the superintendent.

Clarification of materials handling

- Determining the materials needed;
- Requisitioning materials from the stores;
- Ordering supplies which are lacking in the stores;
- Composing supply of data to the manufacturer.

Monitoring

- Monitoring work by means of completed orders;
- Summarizing the work;
- Subsequently informing the orderer (the person who ordered the work to be done) about it.

2.2.4 Classification of jobs in order of relative importance

The organization of work planning is an intermediary function carried out by the orderer and other interested parties.

2.2.5 Responsibility for maintenance

General responsibility for a maintenance job begins and ends with the orderer.

2.2.6 The duties of the orderer

- To allow a reasonable time for the work to be prepared and implemented;
- To keep contact with the organization of work planning;
- To be cooperative;
- To give complete information about the work;
- To use the results of monitoring.

2.3 How to develop the planning of maintenance work

It is difficult to provide a detailed and generally acceptable rule for a function composed of the joint work of people living and working in different environments.

The size of the enterprise is a crucial factor. The age of the plant, the layout and the general organization are also factors which make it almost impossible to lay down generally acceptable rules. However, some features are fairly common in the planning of maintenance.

One such feature is the sudden stoppage of a manufacturing process. In this situation the work-planning organization can rarely act alone. Who takes action in these circumstances? The answer is generally: the line organization, most often the foreman.

Depending on the nature of the stoppage, some planning may be apportioned to the maintenance organization, but often the line organization assumes responsibility. The most important obligation of the line organization is to resume production, always taking safety aspects into consideration.

When the need for joint action on maintenance planning is evident the foreman, who himself plans the work performance, and the work planning organization which is responsible for the necessary resources should cooperate to achieve the following:

- Reasonable sharing of responsibilities;

- Sharing essential data about the machines and mechanisms;

- Long-range planning of resources;

- The right attitude to the work on the part of all the participants, not as separate units but as links in a continuous chain.

3. PREVENTIVE MAINTENANCE

3.1 Introduction

Preventive maintenance is an old concept. The service life of machinery has been extended by greasing since early times. In Finland, statutory inspection of boilers, which can be seen as a kind of preventive maintenance, had begun by the eighteen-eighties.

Along with the increase of industrial activities, the concept of preventive maintenance and its field of activity has been extended. There are varying ideas about the significance of these activities.

3.2 Concepts

Preventive maintenance can be divided into three groups:

3.2.1 Preventive servicing

This comprises maintenance not directly bound to time and for which no time limits are set. The main object of this function is to see that for machines and mechanisms there are a practical recognition system, drawings, instructions, spare parts, lubricants, and a description of the normal running order of the machines in question, and that these have been noted carefully so that operations differing from the norm can be recognized. It also ensures that operators and supervisors have been given sufficient information on normal operating conditions.

3.2.2 Periodical maintenance

Regular repetitions of limited maintenance functions are implemented in accordance with a programme drawn up in advance, usually suggested by the manufacturer. These functions are: cleaning, inspection, lubrication, adjustment and change of parts. They are scheduled in accordance with experience and from the viewpoint of reducing cost.

3.2.3 Predictive maintenance

A composite of the two above has become popular. Because of the development of advanced measuring equipment it is possible to predict the time when repairs will be required. This method is particularly suitable for plants where deterioration is slow, with a small probability of sudden breakdowns. It is most advantageous in cases where spare parts are expensive and the cost of machine shut-downs is high.

3.3 Aims

The aims of preventive maintenance are as follows:

- To reduce the number and length of machine breakdowns and the seriousness of breakdowns;
- To schedule the time required for maintenance in the work programme, thus enabling it to be carried out without undue disruption of the work flow;
- To collect records to consult for modifications and renewals of decisions on production machines;
- To foresee and to diminish safety risks;
- To reduce capital invested in the stock of spare parts.

3.4 How preventive maintenance procedures can be improved

Before preventive maintenance systems can be improved, quite a number of preparatory arrangements are needed. It is advantageous to realize that this kind of work is project work. It is then possible to carry out the work within reasonable time limits. An example of a preventive maintenance project is shown in Fig. 7.

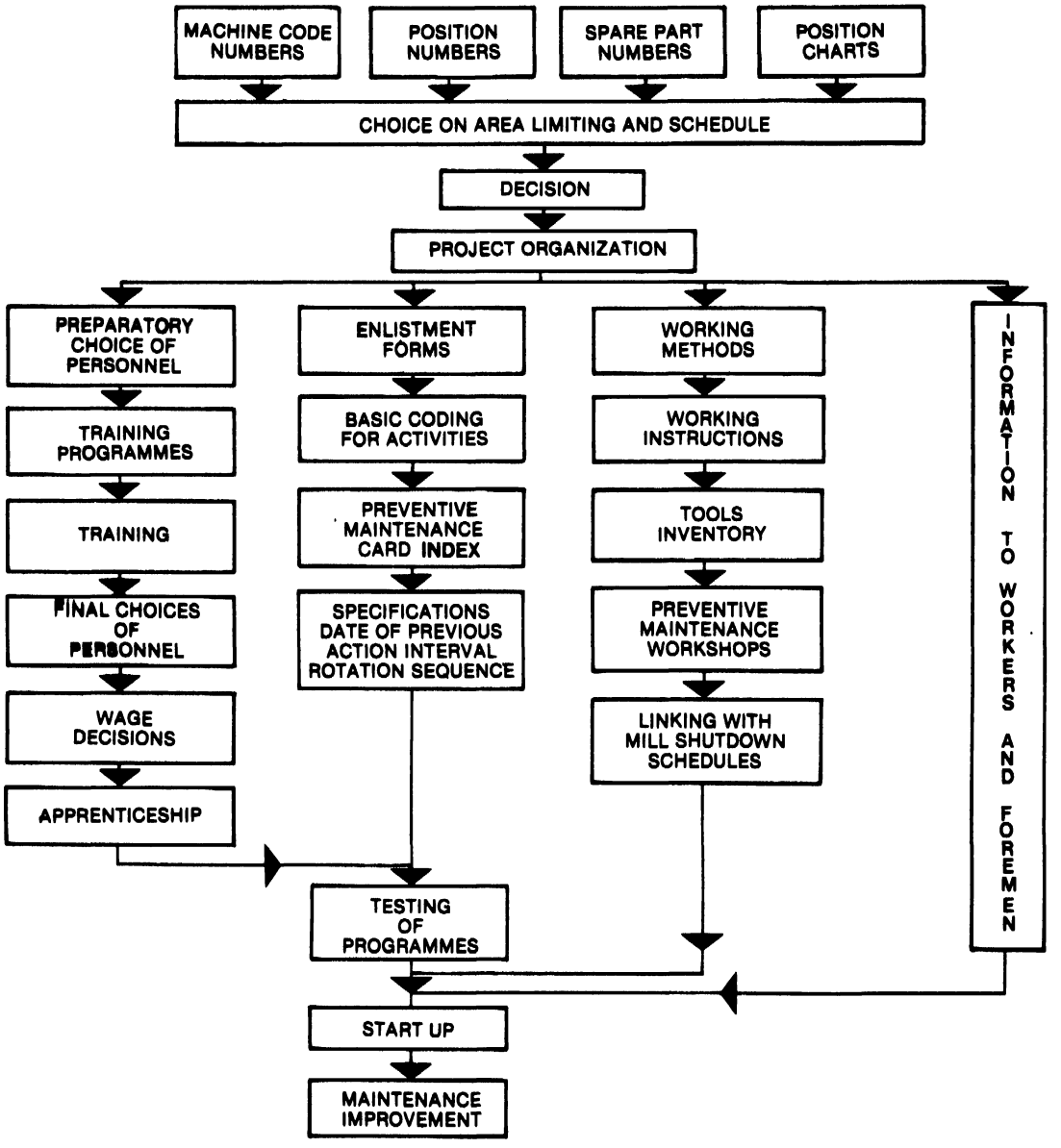


Fig. 7 PREVENTIVE MAINTENANCE PROJECT

At the beginning of such a project the following matters must be clarified:

(a) The most critically important production departments, to be dealt with first;

(b) The procedure to be followed, chosen in accordance with available resources. It may be a lubrication service only, or more sophisticated instruments may be installed to control the operating conditions of the machine, such as instruments for measuring temperature, shock pulse and vibration;

(c) The method of handling data. The choice here is between manual card indexes of different grades, or a computer if suitable programmes are available;

(d) Economic goal. A follow-up method must be developed to show the improvement of productivity in maintenance work, improved quality of products, improved utilization of materials and how work appreciation and safety improve;

(e) The costs which will be incurred in planning the system, the acquisition of measuring instruments, computerization and training;

(f) The project organization. This has to be set up, the project share estimated, the management arranged, and cooperation between different organizations ensured;

(g) A schedule. Enough time must be allowed for follow-up on the intermediary goals. Experience has shown that schedules are usually too tight;

(h) A training programme. The persons responsible for the work must be capable of handling their tasks.

3.5 Continuous improvement of preventive maintenance

It is impossible to create a perfect and permanent data centre as well as a functioning system for preventive maintenance. New machinery will be acquired and incorporated into the system from time to time. Thus, since the machines may be acquired one at a time, the problems at start-up of each machine should be eased. Maintenance requirements alter as a machine gets older, however, and for this reason, the maintenance programmes must also be changed.

The extent of the need for preventive maintenance is influenced by many factors, some of which are listed below.

- Taking into consideration capacity, buffer storages, etc., the machine is located in a critical place in the production process. It therefore demands increased and better preventive maintenance to ensure that it stays operational.

- A long continuous production chain requires relatively more preventive maintenance than a short one, when the same operational security is required of both.

- Drawbacks caused by special weaknesses in some machines can be reduced by increasing the amount of preventive maintenance, while that of machines which are more mechanically sound can be reduced.

- The changes in degree of wear, changes in production requirements or changes in machinery construction also cause changes in the need for preventive maintenance.

- The need for preventive maintenance for a brand new machine and an old one differs greatly.

3.6 The significance of preventive maintenance and achieved results

The need for maintenance is related to the construction of the production plant and the production method. The need for maintenance determines the maintenance functions.

The condition and effective use of the production plant can be worked out on the basis of production results. In these circumstances it is difficult to judge preventive maintenance as a separate function, since it is interdependent on investments, production rate and costs of maintenance. Practice has shown that preventive maintenance, which takes approximately a 10 percent share of all maintenance work, is not unreasonably burdensome.

A development project on preventive maintenance brings benefits which are difficult to calculate in terms of money.

The recording of data creates a foundation for better maintenance and training in a maintenance project results in better work.

3.7 Future aspects

It seems inevitable that computerized maintenance control systems will become more normal in the near future, but they will be in relatively limited use because of their high cost.

Measuring instruments for maintenance will be improved. At present they are reasonably priced so their increased use can be foreseen. Automatic lubrication systems are reliable and easy to operate. However, traditional preventive maintenance systems will always have their own place.

4. SPARE PARTS POLICY

4.1 Introduction

The maintenance of spare parts is an area of systematic maintenance. When maintenance management methods are developed, the management of material has to be given special attention. Capital and storage costs are approximately 20 to 25 percent of the capital invested in the spare parts and supplies lying unused in the maintenance stores. However, during serious interruptions of service, indirect losses caused by a lack of spares could increase costs to several times above the norm. It is this situation which shows that the maintenance of parts is profitable.

Machines and equipment of an industrial enterprise are not manufactured to last forever. Through normal wear, corrosion or for other reasons they will eventually be damaged. Broken-down machinery causes loss of production and raises costs. Precautions against such occurrences should be taken in the form of a proper spare-part policy. Its aim should be to enable the machine to be reconditioned, economically and soon, minimizing shutdown periods.

Spare-part services may be considered as a fundamental system on which other important systems of maintenance are based.

4.2 Concept

Maintenance materials can be divided into four main groups as follows:

4.2.1 Spare parts

Parts are intended for a certain machine or equipment which does not function independently, such as a gear or shaft of an engine. Typical of the supplies of this group is that they come from only one manufacturer - generally the original manufacturer of the machine or equipment.

4.2.2 Exchange parts or equipment

These are complete units composed of several spare parts which are used to substitute a whole machine or a component performing an independent function, such as a gear drive unit or the oil pump of a gear.

Typical items of exchange parts are those production machines which cannot be allowed long periods for repair.

4.2.3 Maintenance supplies

Typical of these is that they have several applications. They may be standard bearings, seals, V-belts, etc. These supplies are made by different manufacturers who use exchangeable products. Goods such as pipes, structural steel and screws are included in this group.

4.2.4 Maintenance materials removed from use

These are usable materials which are not scrapped but are stored for possible use or repair at a later date. This kind of maintenance material comes from the production line when changes are made and the materials removed cannot be installed immediately into another machine.

4.3 Spares requirements

One important question is: which machine should be given priority for spare parts so that it can be kept functioning? It does not pay to acquire spare parts for all machines and some risks must be accepted. The machines which would cause an immediate production shutdown if they stopped are the most important, but they too are in an order of relative importance.

Stand-by machines and exchange parts reduce the need for spare parts but the trend nowadays is to avoid installing stand-by machines. The need for spare parts is also reduced by different cross-line production possibilities.

Determining the needs for spare parts is especially difficult in the first stages of an enterprise, or when new machines and equipment are acquired, of which there is no operational experience, or if machines and equipment are installed in environments where they have not been operated before. The buyer may then have to resort to the manufacturer's recommendations and will easily be driven to excess stockpiling of spares.

A rule-of-thumb often used is that the value of spare parts to be acquired in connection with the investment should be approximately 5 percent of the delivery price of machines and equipment. However, this estimate is valid only if there are excellent communications with suppliers and importers.

4.4 Choice of spare parts

When the development of a spare-part system is started, and individual spare parts for machines and equipment have been selected, it is worthwhile to collect full information. Even small mistakes in numbers, in distinctive codes or in understanding of a foreign language, may prove expensive.

In order to select the necessary spare parts for a machine or equipment, the machine structure, mode of function and conditions of process flow should be well understood, for only then will the choice be successful. In addition, it is worthwhile to make use of the competence of the machine manufacturer.

When acquiring machines and equipment, it is important to have it in writing that drawings and lists of spare parts are prepared by the manufacturer using international signs and codes, and not only the manufacturer's codes. This will make recognition easier and also make it possible to acquire spare parts from a source other than the original manufacturer.

Manufacturers' drawings of parts which wear should also be requested before a business deal is closed. Such wearing parts are: shafts, bushings, fittings, bearing housing, journals, blades, bars, rollers and wheels. It should be possible to manufacture machine parts in the workshop or in the nearest convenient place.

Shorter delivery times gained in this way are particularly valuable when the machines and equipment come from abroad. In addition, drawings appear to be especially important when an "operation-proof" machine breaks down. Dependence on the machine manufacturer is reduced. This often makes more economic sense and makes better acquisitions possible. In some cases, the purchaser may have to make the drawings (and it should be noted that even this is not free of charge). Possession of the manufacturers' drawings makes it possible to test other materials which may be better suited to the purpose.

Manufacturers generally aim at minimizing their own stores of spare parts and manufacturing spares only as ordered. They often use subcontractors to make these parts and only collect a commission. The purchaser should always request a list of subcontractors and the codes used by the manufacturer.

Generally the most economic method is to make purchases of spare parts straight from the original manufacturer, but there is sometimes a contract between machine manufacturers and component manufacturers which prohibits machine part manufacturers from selling direct to the customer.

It may be difficult to recognize spare parts when they arrive if code signs or drawings are lacking. It is reasonable to request the supplier to pack spare parts separately and to mark them either with the purchaser's code signs or his own.

It is worth while to examine shipping lists and forms thoroughly because they may contain valuable information about subcontractors.

4.5 The price of spare parts

When spare parts are selected, attention is generally paid to their price. If the price seems to be high, the decision to buy becomes more difficult. At this point, a comparison should be made between the price of the spare part and the loss of production that will ensue from its lack. The price of a spare part for a machine may be small in comparison with the production loss caused by a shutdown.

The importance of a spare part is also affected by the volume of intermediate product on hand. The volume of final production may not be reduced even if some machine or equipment at the beginning of the process has broken down, since intermediate stores are consumed during the repair period. Spare parts can be classed as insurance. If they are not needed - good - but when needed they will prevent those losses which would have resulted had they not been readily available.

4.6 Priority and interchangeability of spare parts

All spare parts for the same machine or equipment are not of the same operational importance.

If necessary, small alterations can be made to a machine. A sliding contact bearing can be exchanged for a roller bearing, or a mechanical sealing for a twist packing without altering the function or reliability of the machine to any noteworthy degree.

The absence of a spare part does not always incapacitate the machine if one can make use of such tricks. The old part may be kept functioning by welding, or glueing, or with a bushing, for the time required for a new part to arrive at the site.

4.7 Organization of spare-parts service

A code system is basic to an efficient spare-parts service. It makes the recognition of machines and equipment and their geographical locations possible. It must show which spare parts are stored for a certain machine and conversely which machines a certain spare part can serve and where these machines are located. When this information has been collected good order will start to be imposed on the stock of spare parts.

The code sign of a spare part must be so clear that recognition does not require any technical knowledge and ordinary stores personnel should be able to handle the stores function.

Some spare parts could be procured in a routine complementary delivery system, but where a spare part may possibly be reconditioned, a technically educated spare-parts specialist should decide whether reconditioning or a new part is called for.

The number code of spare parts may be descriptive and/or may classify information which would be helpful, particularly in manual coding systems. The inconvenience of this is that it can easily get too long and the possibility of human error increases. On the other hand, a running number may be used. This would require a good machine and spare-part card index or, if a computer is used, some other classifying system based, for example, on the Brussels nomenclature, an internationally recognized coding system.

4.8 Maintenance store capacities

The capacity of maintenance stores must be planned in accordance with the stock requirements of the enterprise. The aim should be to provide effective, flexible and fast service from stores. The concentration or decentralization of maintenance stores depends on the location of the actual maintenance shops.

If the maintenance functions are concentrated at the centralized workshop, the main part of the stores should be in the vicinity of the workshop's registry office. Spare parts and exchange units for only one machine should preferably be located near the place of use.

Decentralized stores have the advantage of making the stock users feel more responsible for the stocks and take a greater interest in whether spares are lacking. The nomenclature list of big central stores appears to be remote and responsibility for the presence of needed spare-parts is easy to shift to the stores organization. A disadvantage of a decentralized system is the task or problem of keeping the stores books up to date.

When storage spaces are planned special attention should be paid to the easy movement of materials and supplies. The arrival and despatch of supplies should follow clearly marked routes so that transport equipment, delivery vans, lift trucks and store trucks can be used without hindrance. The point of distribution should be so located that no unauthorized persons can enter the stores.

The spare-parts stock can be arranged in many ways such as: according to factory departments, types of machines or types of parts. Another important consideration is special requirements of the stored parts, such as temperature or humidity (corrosion).

Special storage places are needed for other materials used in maintenance, such as lubricants, combustibles, welding gases, paints, voluminous pipes and steel sheets, rejected machinery and scrap.

4.9 Development perspectives

The spare-parts policy of an enterprise is to an ever-increasing degree directed to the use of exchange parts. In this way, expensive shutdown periods are shortened. Stores services are developed with the aim of reducing the visits of maintenance personnel to the stores. Even now 95 percent of calls at maintenance stores can be taken care of by telephone or by access to a display terminal. Stores transport services deliver spare parts where they are needed and thus the time of skilled workmen is not wasted wandering between their workplace and the stores.

In many cases, merchandise stock on consignment is used. In this system the suppliers' stock is located in the factory grounds and the suppliers are paid according to consumption.

Modern computer-aided techniques provide a means of speeding up acquisitions by transferring information of a minimum-stock alarm straight into the supplier's sales department without intermediate red tape and handling of paper.

Manufacturers and suppliers keep registers of machinery delivered and at times it may be possible to cannibalize an incomplete machine or part of it for temporary use. In other instances, industrial plants may agree to establish a bank for expensive and exceptional parts.

Today it is considered a rare occurrence for production to be discontinued for some days because of the lack of stand-by machines or parts. This is due to well-organized spare-parts maintenance services.

5. MILL TRANSPORT

5.1 General

A condition for an unbroken production process is a well-organized transport system connected with it.

In accordance with requirements, transport can be divided into two part-functions:

- transport needs caused by the production process;
- transport needs caused by the maintenance of production machinery.

The choice of production-plant transport systems and equipment is always determined largely by local conditions, the requirements of the goods to be transported and technical characteristics of the transport means. Requisite assets for efficient transportation are flexibility, operational reliability and economy.

Maintenance is generally a minor part of the aggregate needs of an industrial plant when measured as a product. For this reason, transport means and methods are broadly laid out according to the requirements of the production process.

Transportation connected with maintenance and problems pertaining to this as well as possible solutions to them are examined below.

5.2 Transportation connected with maintenance

The reasons for transportation problems are various. Because of the variety of materials which must be handled by maintenance, it sometimes happens that the kind of vehicle which would be used for this transport cannot be found within the enterprise. This quite often happens when large and heavy parts and machines must be transported. Generally, however, this kind of transport does not turn out to be urgent. Internal transport problems may also occur in the factory because of a lack of cranes.

Since transport has been organized to move products the equipment and methods have been designed and acquired to serve these purposes. Therefore there are cases where a true transport department and its equipment do not exist and maintenance transport has to be carried out by production transportation units. This raises uncertainty about where or from which production unit the transport vehicle has to be ordered.

A conclusion to be drawn from the above is that generally speaking the main streams of internal transport (in other words, the ones connected with production) are handled more successfully than the often sporadic maintenance ones. For this reason, it is of prime importance that maintenance transport be foreseen as a need, and arrangements made for it.

5.3 Maintenance transportation for industrial plant projects and for renovation

5.3.1 Layout and plant design

When new industrial plants are still in the design stage or while old plants are in the process of being renovated, maintenance transport equipment should already be considered. By this time, the entire process should be examined machine by machine and a rough maintenance plan sketched out, listing the machines to be repaired on the spot and those to be transported somewhere else for repair. Around machines which will be repaired on the spot, ample free space should be left.

5.3.2 Doorways and lifting traps, passages and pulldown walls

When dimensions of doorways and internal passages are being decided, it should be remembered that the production machine or equipment alone does not determine what space is needed but the total size of the unit formed by the machine to be transferred plus the transport system and/or lifting machine that will move it.

There should be enough doors or gates planned for the walls and roofs of an industrial plant, especially where the machine or equipment is so situated that it can be removed from the building in one lift. Large machines usually create transport problems. Small machines are generally easy to move through interior routes.

Modern element-construction allows part of a wall or roof to be removed for the transport of an especially large machine or equipment. Such cases are for extraordinary or rarely repeated maintenance operations because the demolition of a well-designed wall is no small job.

5.3.3 Hoists

Often machines have to be located where they cannot be reached by any transport and lifting machine (lift truck, mobile crane, wall crane, etc.). For these cases there should be a hoisting beam above the machine so that it can be transferred within the reach of a transport vehicle.

Whether to install a permanent or temporary portable hoist on the beam will depend on the frequency of repairs required by the machine.

5.4 Character of transport

Maintenance transports can be categorized according to their characteristics.

5.4.1 Planned transportations

Maintenance transport machines are generally a contributing factor in planned repair work, closely incorporated into the execution of the whole work. This kind of repair work consists of a series of operations which include detachment of the machine, lifting, transportation, repair, lifting and re-installation.

Because this type of operation is becoming more usual, thanks to the improvement of lifting devices and transport equipment, correct timing of transport is important to the smooth running of the repair work. Thus, when repair work is being planned, the person responsible for the transportation side of the operation should be informed at the earliest stage.

5.4.2 Periodic transportation

In maintenance work there are several functions which do not immediately affect the flow of the production process to any noteworthy degree; for example, the maintenance of sewers and water pipes, rail tracks and roads. The transportation needs for this can in many cases be defined as regularly repeated functions, e.g., garbage transport, rolling of roads, salting and sprinkling of streets. Transportation of material from storage to repair points can be arranged at certain intervals, taking into account the need to load and unload. Often loading and unloading problems can be solved by providing the transport vehicle with the necessary extra equipment.

5.4.3 Installation transportation

A characteristic of installation transportation is that it is usually needed once only. The size of the material to be transported may vary from a small hand-carried piece to units weighing tens of tons. Other characteristics of the materials may vary from one extreme to another.

Naturally a factory seldom has the transport equipment available for all the above and thus must seek aid from special services outside.

Because location factors may set special requirements for transport in the installation stage, these must be closely examined. They may include, for instance, road conditions, clear distances (width and height), transport levels, extra constructions (installation stands), lift openings, transport and lift order, and intermediate storing places. Special attention must be paid to work safety.

5.4.4 Urgent transport needs

This kind of transport is especially required in the following circumstances:

- when the person who needs the transport has been negligent or forgetful;
- when the material in question is needed urgently.

Whatever the reason, it may be common to both cases that there is no proper transportation equipment available.

It is also probable that the production process is either being closed down or in danger of it. Transportation in such circumstances will not usually be the best, technically or economically speaking.

If such transport needs occur often, the matter should be thoroughly examined and a solution sought to eliminate the problems.

5.5 The organization of transport

The organizational system does not have great significance for maintenance transportation. What is important is that when transport is needed there is accurate information on where the vehicle is to be sent and from whom it is to be ordered.

5.5.1 Transport centre

Orders for transport may be concentrated on a centre where those who need it make their requests. The centre personnel select the most suitable means to find the right transport. A condition of its efficient operation is that the centre controls all transport means or can make them available. The person who orders transport should be a member of the superintendence of the maintenance department.

5.5.2 Transport department

The transport department of many industrial plants is under the supervision of the maintenance service department which is responsible for mill maintenance. This department is responsible for the maintenance, repairs and cost control of the transportation means ordered from and commanded by it. The transport and the maintenance departments together examine the needs and timing of periodic transport.

The transport means are handled by persons nominated especially for that duty. The transport department is responsible for the training of its personnel. The training includes in addition to technical command of the vehicles, other matters such as cooperation, responsibility and work safety.

5.6 Means of transportation

Because the transport needs of maintenance departments are only a small part of total transportation needs in an industry, it is natural that the vehicles are provided mainly to meet production requirements. Through small changes, these vehicles could also be made available for

maintenance purposes. In general, the transportation means of an industrial plant are lorries, tractors and front loaders, and those for special maintenance purposes are mobile cranes, service trucks and tractors.

5.6.1 Cranes and containers

The usefulness of a lorry or a tractor-trailer combination can be augmented by a crane or a back-board hoisting crane, which will make loading and unloading easier and obviate the need for special facilities for these functions.

Loading and unloading is made easier by the use of interchangeable containers. Industrial plants usually employ them, especially in garbage and trash transport. Container systems can also be used with tractors. On the other hand, the relatively less expensive delivery price of tractor-trailers may make the so-called change-trailers more convenient. As a general working machine, a tractor is applicable to other needs such as road maintenance.

5.6.2 Trucks

Trucks form a big group in transportation equipment. There are numerous types, the most usual being those with supporting legs (outriggers), push-boom trucks and back-balanced trucks. Their driving mechanisms are either combustion engines or electric motors. Their hoisting capacity varies from a few hundred kilos up to tens of tons. Generally their lifting heights are in the range of three to five metres, though special trucks lift over ten metres.

Trucks are used for in-plant and external transport needs. The truck may take and leave its load without auxiliary equipment if the load is dimensioned to fit the forks of lifting devices on the truck. Outdoor trucks generally need better roads than lorries or tractors. In addition to transportation, trucks can be used for maintenance lifting works.

5.6.3 Front loaders

Different types of clam-shell and general loaders have similar applications in maintenance.

The use of loaders is less frequent than that of trucks, however, because loaders generally operate in close connection with the loading process. With different auxiliary devices the usefulness of a clam-shell loader is well adapted to the maintenance of different types of roads.

5.6.4 Light transport equipment

Closed or delivery vans are well suited to transport small objects. They can be used flexibly, such as for periodic distribution of materials. Besides vans, motorcycles can be used for goods deliveries.

5.6.5 Other types of transport machinery

There are generally numerous different types of bridge and mobile cranes in industrial plants. Most of them are installed especially for maintenance work. Lifting equipment may be complemented by mobile cranes which can be used for different lifting and transport services.

The transportation equipment listed above is what is most often used in Finnish industrial plants. With the addition of different auxiliary devices its use for maintenance transportation is practical. One of these auxiliary pieces of equipment, which has come into more general use of late, is the vehicle telephone, with which the effective operation of a vehicle can be significantly increased.

6. MILL SAFETY

6.1 General

Safety is one of the most important functions of an enterprise. Even though some aspects are handled according to rules and regulations of the authorities, the effectiveness and purposefulness of safety arrangements is in the hands of the enterprise.

The goal of mill safety arrangements is to avoid all kinds of accidents and mishaps through preventive measures and also, if accidents do happen, to be capable of limiting their consequences to the minimum.

Mill safety arrangements can be divided in accordance with different group risks as listed below:

- Accident prevention
- Fire protection
- Environmental protection
- Guard duty
- Confidential information safety
- Special mill safety

All the above-mentioned functions together form one big body within an enterprise. Mill safety depends on all personnel being safety-conscious in their daily work. A mill safety programme must not become only a series of exercises carried out from time to time, but must be continuous. It must have an impact on personnel so that its significance is understood by individual workers throughout the enterprise. In order to obtain satisfactory results, goals must be definite, which presupposes that management clearly outlines the safety policy to be observed. Goals and responsibilities should be pointed out.

6.2 Coordination of the safety system

In order to obtain good final results in any endeavour, it is necessary to concentrate the available resources on reaching the most important goals. This concerns safety matters as well.

Mill safety contains parallel, even coordinated needs and problems. Therefore the expertise of various departments and persons should be used in handling matter of safety. In practice, this work can be coordinated by the "safety manager" and different working groups organized for this purpose.

The organization of mill safety, mainly as regards fire protection and guarding, is examined in the following subsections.

6.3 Safety organization

An effective mill safety unit, corresponding to the requirements of an enterprise, must be organized. Responsibility must be assigned and subordination must be clear, especially because conditions may arise which create disorder, such as fires and accidents. Decisions would have to be made quickly and actions concentrated to guarantee effective functioning of the available persons and facilities. Each enterprise must individually consider the structure of the mill safety organization, taking into consideration such factors as the size of the enterprise, the location and the kind of production. Each protection organization has its own characteristics.

The basic principle, however, must remain that safety is a part of the everyday work of the enterprise and, as such, it must be structured like a line-organization. Such a scheme is shown in Fig. 8.

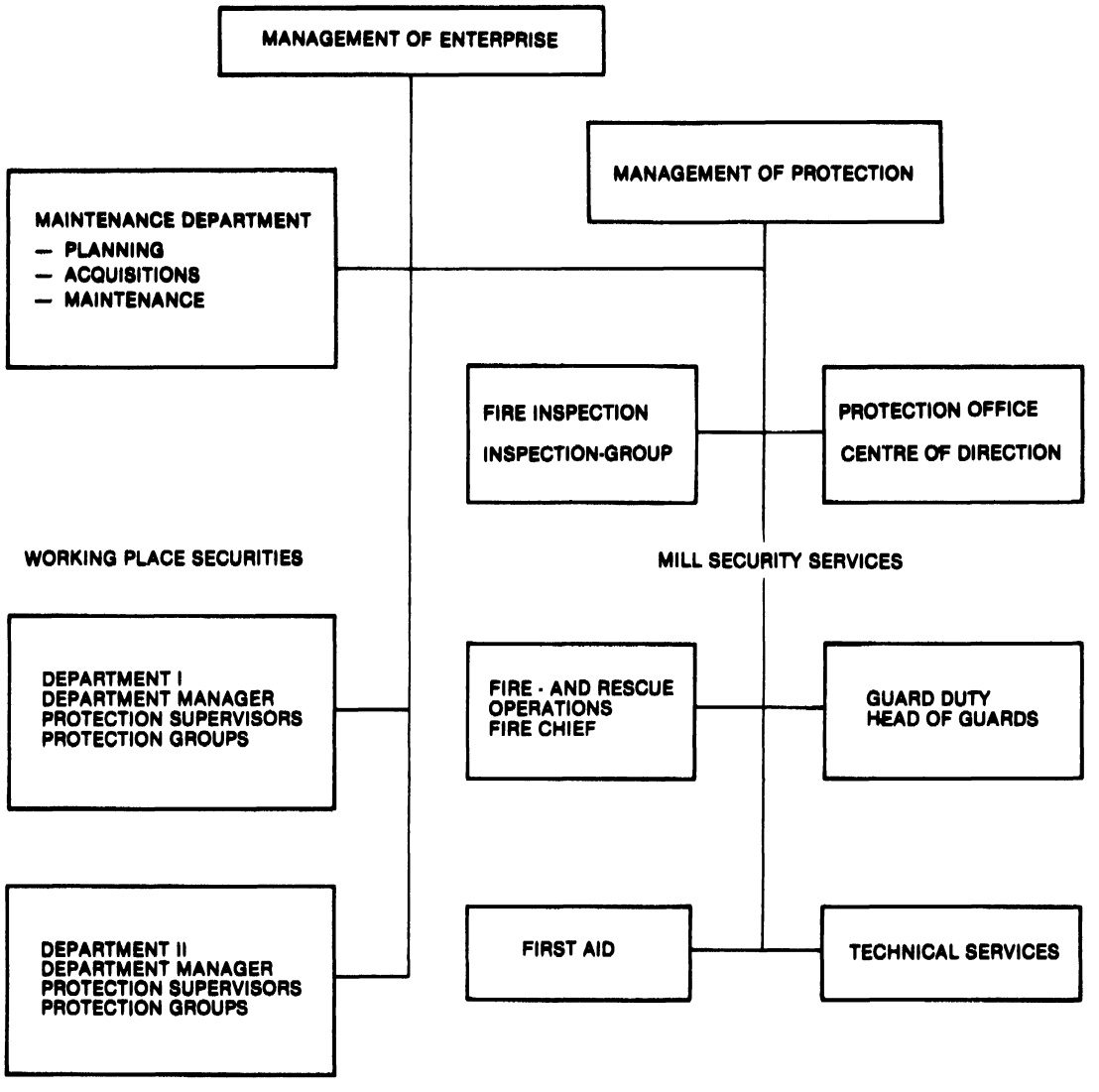


Fig. 8 SCHEME OF SAFETY ORGANIZATION

As may be noted from this scheme, the management of an enterprise is responsible for the general arrangements for mill safety and of centralized management of security activities with the aid of an appointed management group under a manager.

The organization of an enterprise includes functional or territorial divisions, each one handling its own safety sector. In addition, the whole industrial plant needs common safety services to handle matters such as guard duties, fire and rescue operations and first-aid.

6.4 The duties of the safety organization

The structure and duties of the units in such an organization are broadly presented below, except for the duties of the fire inspection group which are given in more detail to emphasize their importance.

6.4.1 Mill safety manager

His main duty is to draw up the safety plan for the mill, keep it up to date and supervise its implementation. In addition, he is responsible in practice for fire prevention, fire-fighting and ensuring that safety groups are effectively organized. A condition for all this is his participation in the early stages of planning the plant.

6.4.2 Fire inspection group

The task of this group is to supervise enforcement of the rules and protection instructions on fire prevention, and to make suggestions for improvement of fire-fighting.

The group should ensure by examining it at first hand, that fire-fighting equipment functions as planned and that no fire hazards exist. The group should check the following:

- That sanitation and regular garbage-disposal services function;
- That primary fire-extinguishing appliances (hand extinguishers, fire hydrants, water-hydrants in buildings and fire hydrants with hoses) are in good condition at marked places and serviced at stated intervals;
- That structures like sectionally operated walls, fire doors and trap doors are in good and serviceable condition;
- That technical operating equipment like heating and electrical appliances, insulation, etc., comply with rules laid down by the authorities;
- That hazardous material such as liquid combustibles, liquid gas and inflammable residues are correctly handled and stored;
- That fire-hazardous work like welding and acetylene sheet-metal cutting/burning is carried out with caution.

It is important that the members of the inspection group pay attention to the functioning of the organization. Clean-up work and maintenance of primary fire extinguishers and of welding equipment should be organized to achieve adequate standards of fire safety.

During inspections, special attention has to be paid both to new objects and to those where alterations have been made. The frequency of inspections depends essentially on the branch of industry. Guidelines for inspections could be as follows:

Inspections at three-month intervals for:

- mechanical woodworking industry
- textile and leather industry
- installation working places

Inspection at six-month intervals for:

- paper industry
- metal industry
- steam-operated power stations.

During inspections minutes should always be taken in which defects and proposed measures to repair them are recorded.

6.4.3 Department manager

The department manager is responsible for seeing that equipment is in good condition and that functional procedures are carried out correctly, in accordance with the rules and instructions laid down by the safety management, and that all personnel of the department are given proper safety training.

6.4.4 Protection supervisor

One of the jobs of the superintendents is to appoint protection supervisors for each shift. The supervisor heads the preventive protection functions at the work place within the limits of his responsibilities.

6.4.5 Protection group

To assist the protection supervisor a protection group should be formed at the workplace. The number of people in such a group should be from three to five, of whom at least two should have fire-fighting training. One should have first-aid training. When needed, the protection group can also include other specialists like mechanics and electricians.

The protection group checks that working places are in the condition required by the rules and protection plan. It initiates the first active protection and rescue operations in a dangerous situation.

6.4.6 First aid

First-aid groups complement the protection group's activities in case of accidents.

6.4.7 Planning

At the planning stage the laws and rules concerning fire and other protection instructions and standards connected with mill security should be reviewed and applied.

6.4.8 Acquisitions

When acquisitions are made, the official rules in force must be adhered to, as in planning. The purchasing department takes care that the mill safety manager is consulted in formulating protection instructions to be included in the contract acquisition.

6.4.9 Other functions

Because industrial plants differ considerably from each other as to their size, products, effective production rate, location and so on, detailed instructions for all protective measures cannot be given here; but they must always be applied bearing in mind the local conditions.

However, there are methods by which the biggest risk factors can be systematically recognized and their significance estimated. One such system is HAZOP (Hazard and Operability Study).

After an evaluation of their seriousness, risks can be placed in order of relative importance, and the work required to prevent damage can be directed to the correct places. In this way it is also possible to optimize the total costs in accordance with the curves presented below.

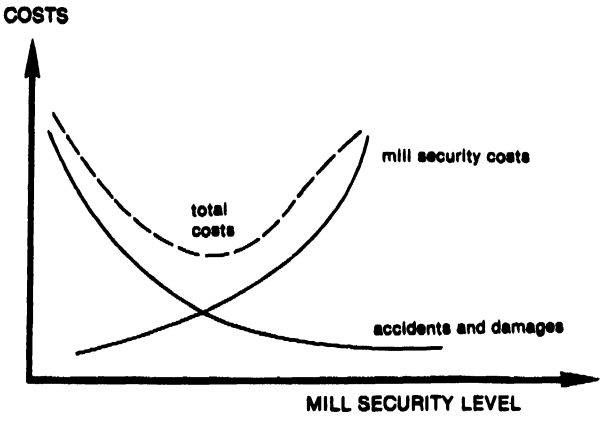


Fig. 9 OPTIMIZATION OF SECURITY LEVEL COSTS

6.5 Guard duty

Guarding a mill involves several activities:

- firewatching
- surveillance of motor vehicle and passenger traffic
- supervision of transport vehicles and transport operations
- guarding against break-ins
- surveillance of welding and other potentially hazardous jobs.

Local conditions like plant size and the value of property to be protected determine the needs of guard duty, its extent and centre of focus. The location of the mill itself and its environment determine the structural factors which should be considered when fences are planned and gates and traffic routes are placed and constructed. These matters should be considered at the planning stage.

A mill is guarded by both gate guards and watchmen on the beat. The watchmen's beat may be covered in a motor vehicle if the area of the plant demands it.

The effectiveness of guard duty can be improved by supplementing watchmen with television control, with automatic burglar alarms and with other instruments and gadgets.

Because fire watching is the most important aspect of guard duty, it should be given special attention when the duties of guards are planned. The whole organization of guard duty should be based on specific, detailed duties as well as instructions on what action to take in different situations.

6.5.1 Organization

An "organogram" showing the structure of a security organization is shown in Fig. 10. This is followed by a series of duties and instructions for the head guard of a fictional woodworking plant with two individual mill units and two fenced-in factory areas. The mills also have TV devices which are used to survey the area.

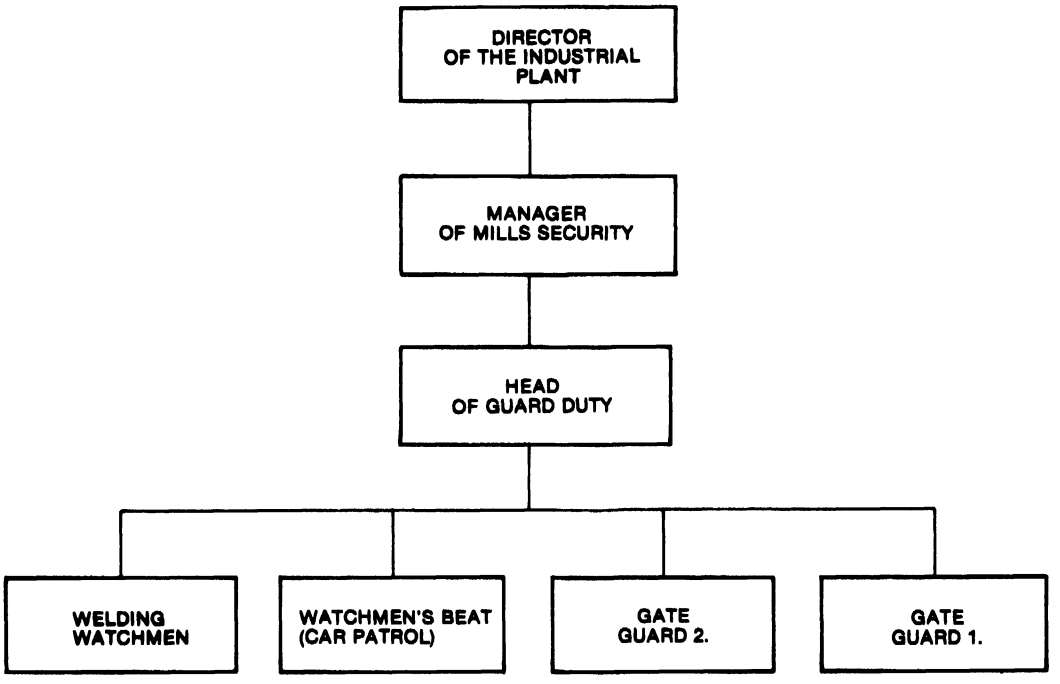


Fig. 10 STRUCTURE OF SECURITY ORGANIZATION

6.5.2 Duties and instructions for the head guard

The head guard is responsible for the practical carrying out and control of guard duties and he acts as inspector of the guards.

He reports to the mill safety manager.

His duties and responsibilities are as follows:

- He draws up the plans for guard duty for approval by the mill safety manager and proposes alterations as needed;
- He draws up plans for training the guards, puts the plans into practice and takes care of complementary training and continuous instructional activity (at least once a year);
- He checks daily guard reports and takes steps to correct defects recorded by guards in their reports;
- He receives reports made by guards or others (by telephone in urgent cases), takes immediate steps to get the matter cleared and notifies the mill safety manager when necessary;
- He is responsible for the acquisition and maintenance of every appliance needed in guard duty;
- Through routine inspections, he controls the condition of fences, gates, doors and windows of buildings, locks and technical control devices in the factory. As needed, he orders repairs immediately;
- He ensures that guards are properly dressed and is in charge of acquisition of uniforms;

- He ensures that guards are able to guide visitors in the mill area;
- He looks after the working relations of the guard force;
- He cooperates with mill departments in guard-duty matters;
- He organizes reinforcement of guards for special occasions;
- He cooperates with authorities in matters of order;
- He follows the development of guard-duty service and proposes improvements to the mill safety manager.

Corresponding instructions could be formulated for the guards. On the other hand, it is not enough to have a list of instructions. There must be a continuous control, indicating that the instructions are adhered to and that they are always kept up to date.

6.6 Summary

The objective of industrial protective activities is to protect human lives and property and improve operational safety through the following measures:

By organizing protective activities;

By drawing up plans and rosters for guards;

By training personnel;

By minimizing situations which lead to damage or danger;

By limiting damage in accordance with the preventive plans;

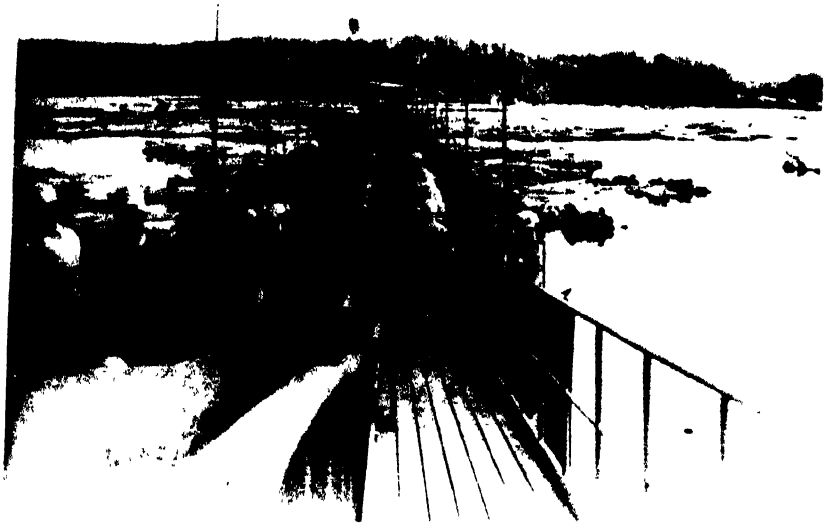
By ensuring strict observance of laws and rules on fire and other safety matters.

A protection organization should be planned following the line-organization structure with safety at the workplace forming a basis for protective action.

Protective services should complement safety at the workplace if its own activities are inadequate.

The extent and organization of protection depend on local conditions, capacity of the industrial plant, fire hazards and the value of the property under protection.

The management of the enterprise is responsible for planning and execution of all protective measures.



Sawlog storage in water and log conveyer
(Photo: H. Seppanen)

Green sawnwood waiting to be stacked for kilndrying
(Photo: H. Seppanen)

MARKETING AND MARKETING MANAGEMENT

by

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1. INTRODUCTION

The purpose of this paper is to introduce the concepts of marketing and marketing management and to give some examples of their application possibilities to forest industries. The paper is divided into two main sections: Marketing Concept and Marketing Management.

It appears that relatively little has been done to describe in commonly available texts the total marketing function of forest industry enterprises. Therefore, one of the objectives of this paper is also to increase the awareness of the need for additional work in this respect.

Marketing, as a science, is relatively young and its application to forest industries, which has been a rather conservative sector of the industries, has been of even more recent origin. The problem really arises in trying to find descriptions of marketing practices in the forest industries in developing countries.

Marketing did not, of course, exist in its present forms when the forest industries in the now industrialized countries were at the same level of development as are the industries in developing countries. Therefore, the industries in developing countries, although in their early stages, today have at their disposal an advanced marketing theory. In order to apply the theory most efficiently to the forest industries in these countries, it is necessary to identify two main items:

- The specific characteristics of the forest industries;
- The specific conditions in the developing countries.

Although this paper will try to compile a framework of the basic marketing theory so that the main components can be understood, it is the characteristics of the industry and local conditions in the market place which ultimately determine the most appropriate form in which to apply the theory in practice.

A list of references at the end of this paper provides names of textbooks and articles for further reading.

2. THE CONCEPT OF MARKETING

In this chapter an effort will be made to define marketing, to distinguish industrial marketing from consumer marketing, to introduce the individual components of marketing mix and to give some examples of components which could be of most relevance to forest industry products.

2.1 Definitions of marketing

A great number of definitions of marketing can be found by going through appropriate articles and textbooks on the subject. These definitions vary depending on the marketing philosophies behind them. Different authors present varying numbers of philosophies, e.g. Kotler lists five main types; Thorelli has condensed them into three which have evolved over the years and still exist in one form or another.

The earliest concept of marketing was product- and production-oriented. Typical of this was the concentration on producing as much as possible with production methods as efficient as possible. Marketing was composed of delivering the goods to customers and marketing was understood to mean the same as selling. This was acceptable during the early stages of the industrial revolution when industrial production meant taking advantage of the economies of scale effect and making the products extremely competitive compared with the products made by artisans.

The second stage in marketing philosophy recognized the customer and his needs and wants as the starting point. Once the supply had begun more or less to meet the quantitative demand, customers started to become more choosy and marketing started to reflect their wishes back to the production units, which tried to concentrate on making products which could be sold.

The most recent philosophy in marketing is called ecological or strategic marketing. According to this concept a company's activities are in a continuous interaction with the surrounding business environment. The final aim is not just production, the product or the customer, but a package of common benefits, which the firm can supply continuously. This means continuously taking into account changes in the business environment and adjusting the company's activities to those changes, making the fullest use of the company's strengths and by correcting its weaknesses to seize opportunities in the market.

Hughes has provided a definition of marketing which seems to follow the ecological marketing philosophy. He states that "marketing may be defined briefly as those activities that relate an organization successfully to its environment. The main activities are:

- The correct identification of needs;
- The development of products and services to meet these needs;
- Pricing;
- The distribution of goods to the market place;
- The communication of the ability of the products and services to meet these needs."

Webster has defined marketing in a similar way. He states that "marketing is the function by which a firm or other economic organization designs, promotes and delivers goods and services for customers and clients. The hallmarks of modern marketing are customer orientation and a long-range, or strategic, viewpoint that make an organization responsible to its ever-changing environment."

The definition by Kotler appears to concentrate on the customer. He states that "marketing is the means by which organizations identify unfulfilled human needs, convert them into business opportunities and create satisfaction for others and profit for themselves."

Many forest industry companies still have too many features of the production- and product-oriented view in their marketing approach. There are specific reasons for this, of which the following are some examples:

- Forest industries are technology intensive which means that technical considerations often dominate the attitudes of management;
- Forest industry products are usually industrial semi-processed goods and thus technical features are dominant characteristics;

- There are still some bulk markets where quantity is thought to be more important than anything else. For instance, some types of sawn wood have to be produced to certain standardized rough specifications and the only thing which matters after that is the cost which has to be as low as possible.

However, many forest industry companies have come to realize that they cannot just continue to produce what is easiest for them technically, and they have had to take into account the wishes of their customers. They are trying to produce what they can sell. These companies, therefore, study the needs of the customers and try to satisfy them as well as they can. This type of marketing, in which customer satisfaction is one of the main goals, is possibly the most common used in forest industries today.

The most sophisticated companies from the marketing point of view are applying strategic marketing concepts. They evaluate the continuously changing environment to detect opportunities which could be met by the strengths of their company or they try to foresee any threats which should be tackled either by applying the strengths of the company more vigorously or by correcting their weaknesses. In this approach the company views its operations not as individual functions but rather as a whole in which each function supports the achievement of strategic objectives set up for the company as a whole. In this approach, therefore, the company tries to market a product that customers need and that the company is good at making. As stated by Thorelli, "By taking into account both client needs and own resources the ecological marketing concept in effect combines the producer-oriented and the customer-oriented points of view in a way that yields more meaningful conclusions than those which might be reached by either of the older approaches."

In forest industry companies, the strategic marketing approach would seem to be ideal because it simultaneously takes into account the customers' needs and the company's resources. The resources of a forest industry company are very difficult to modify at short notice. Raw material resources, i.e. forests, mature slowly and are of a relatively fixed composition. The technology of the industry has been designed for specific products and it cannot easily be changed. The high capital intensity of production units is also a deterrent to rapid changes. Although not a unique feature of forest industries, the development of human resources requires a long-term orientation. Consequently, the needs and wants of customers have to be adapted to the possibilities which the resources of the forest industry company can sustain. It therefore becomes vital that a new forest industry company evaluate its market opportunities extremely carefully before deciding on investment in a new mill or modification of an existing one.

Although marketing is often confused with selling, selling is a vital function within marketing. It is concerned with implementing some parts of marketing and is based on operational decisions. Further characteristics of selling include its short term, and its field orientation. Marketing is more concerned with planning which provides a basis for both short- and long-term decision making. It also continuously formulates and maintains the relationship between the buyer and the seller. Sales of industrial products record the flow of activities between buyer and seller rather than indicate the completion of the relationship, which is usually the case with consumer goods.

2.2 Consumer marketing vs. industrial marketing

Goods and services are traded either between the sellers and final consumers or between the sellers and processing industries and other organizational customers. The former type of relationship between the seller and the buyer is called consumer marketing; the latter, industrial marketing.

Consumer marketing is the marketing of goods and services to individuals, households and families. Industrial marketing is concerned with the marketing of goods and services to industrial users or institutional customers. The latter use the goods and services either (a) by combining them into new products; or (b) by using them as supplies in operation, repair and maintenance; or (c) by providing additional services with the products. The comparison of criteria below shows some of the typical differences between the two basic types of marketing.

SOME TYPICAL DIFFERENCES BETWEEN
CONSUMER AND INDUSTRIAL MARKETING

Criteria for comparison	Consumer marketing	Industrial marketing
Customer/utilizer	Individual, household, family	Business firm, government, institution or other type of organization
Buyer	One single individual	Purchasing unit or an organization
Buyer/seller relationship	Often sporadic. Usually ends with the sale	Usually close and lasting. It does not end with the sale
Changes in the sources of supply	Flexible	Less flexible
Buying process	Usually simple	Complex
Quantity	Usually small	Usually large
Overall corporate strategy	Not very close relationship	Close relationship
Product	Usually standardized	Made according to customer's specification
Service	Important only in some cases	Usually important
Price	Negotiation usually not possible	Negotiation important
Distribution	Direct contacts between producer and user unusual. Channels usually long	Direct contact between producer and user important. Channels usually short
Communication	Usually more subjective and appealing to emotions	Usually more factual and direct
Marketing research	Data usually readily available and often collection based on samples. Analysis based on quantitative methods.	Data available often only on aggregate level. Details have to be collected through interviews. Analysis relies much on qualitative as well as quantitative methods.

Most forest industry products are semi-processed goods which are sold to other industries or institutional users for further processing. They are, therefore, typical goods for industrial marketing. Sawn wood, for instance, is in only a few cases sold directly from the sawmill to the end users. Indeed, most of a sawmill's production finds a market among construction companies, furniture manufacturers, railroads, public works and wholesalers. These all add value to the products either by processing the sawn wood further, e.g. in furniture factories, or by adding services to the product, e.g. wholesalers provide a wide selection of sawn goods which are readily available from store and in some cases extend some credit to the buyers. The importance of the interdependency between the buyer and the seller originates in the need of the buyer to be sure of a continued supply of goods to keep his own processing unit in operation.

The same applies to the service requirements. Whenever there is a major technical problem related to the product, the buyer likes to have the supplier provide service efficiently. Furthermore, the buyer, because of the close relationship, tries to guarantee a uniform quality of product, which is also vital for running his own equipment and machinery efficiently. Once the buyer has tuned his own production to a certain supplier, his possibilities of changing the source of supply become less flexible. The goods and services which he buys have been made to his specifications and if he wants to switch to another supplier there may not be a similar package readily available.

Due to the great number of issues involved, the buying process in industrial marketing is a complex one. The customer is represented by a special purchasing unit which is backed up by other units of the customer company, such as research and development, finance and production. The seller has to deal with several individuals of the customer organization either directly or indirectly. Furthermore, the quantities traded are usually large. The seller has to make a total commitment to meet the customer's requirements. Therefore, the various functional units of his own company (finance, production, personnel, research, development and marketing) have to operate in close harmony, constantly evaluating customer requirements against the strengths of the company and those of its competitors.

2.3 Components of marketing mix

The definition of marketing by Hughes lists a number of activities that relate an organization to its environment. The following are mentioned:

- Products and services
- Price
- Distribution
- Communication.

These are actually the most essential means by which the company can satisfy its clients' needs and wants. They are always applied as a package which is called the marketing mix. Marketing strategy makes the elements of the mix work in a coordinated fashion, which will result in benefits accruing from the synergy of the components, i.e. together they provide more benefits than just the sum of the individual variables. These variables can be controlled by the company to a lesser or larger degree.

For instance, in forest industries, price is often preset by the demand and supply situation in the international market and the company can therefore use it to only a very limited extent. The product and its quality, on the other hand, are dependent on the technical abilities of the company.

All these factors have a role to play in the efforts of forest industry companies to market their products. Some of them have more weight in the marketing mix than others, depending on the type of need and want which the company tries to satisfy.

There is also a distinct difference between consumer marketing and industrial marketing in the relative importance of marketing mix components. Some authors have tried to group individual marketing mix components into categories. For example, Frey has divided them into two:

- The offering which is composed of the product, price, service, brand and packaging;
- Methods and tools which include distribution channels, personal selling, advertising, sales promotion and publicity.

The classification of marketing mix components by Lazer and Kelley recognized three groups:

- Goods and service mix
- Distribution mix
- Communication mix

By using the classification called the four P's (product, place, promotion and price), popularized by McCarthy, one can list the following components which are of relevance for most forest industry products:

Product	Place	Promotion (characteristics)	Price
Quality	Locations	Personal selling	List price
Size	Coverage	Sales promotion	Discounts
Tolerances	Channels	Publicity	Allowances
Dryness	Inventory		Terms of payment
Packaging	Transport		Terms of credit
Services			

In the following, each variable of the marketing mix will be reviewed in more detail.

2.4 Product

Forest products are in general either raw materials or manufactured materials and parts. Raw materials originate either in natural forests or in plantation forests established by man.

Component materials are the most common type of manufactured goods. Sawn wood, wood-based panels, pulp and paper all belong in this category. Further processing of sawn wood, wood-based panels and paper results in products which are called component parts. Examples of these include prefabricated building components such as wall elements, window frames, doors, corrugated board and railway sleepers. It is important that the products are further divided into more detailed grades.

Each product grade has several characteristics of importance. Quality is possibly one of the most important ones. From the marketing point of view, it is a variable which the company can influence through the proper selection of raw materials and processing technology and through skilful operation of its facilities and efficient quality control. Customers do not only require good quality, they also want to be assured that the quality will be consistently good so that the product adapts itself for further processing on the customer's machinery.

Standards for quality control have, therefore, to be set high and an appropriate system for continuous control of quality be established. Changes in the requirements of customers must be monitored and adjustments in quality made as necessary. The quality concept in a forest industry may include such diverse characteristics as stress resistance or printability, depending on the product and grade.

Particularly in the case of mechanical wood products - sawn wood and wood-based panels - size and tolerances are important characteristics, as is dryness. Packaging in general has had a mainly protective function but it is being increasingly used to serve as a means of communication. It is therefore important that the packaging emphasize the image the company wishes to have among its customers.

Service is closely related to aspects of quality. In industrial marketing, service is often required to remove product-related problems. For instance, in paper marketing, the sellers often work closely together with the converters to adjust the quality of the paper to the machinery of the customer and they are ready to provide technical assistance whenever the customers run into processing problems.

2.5 Place

The second 'P' in the popular classification of marketing mix components refers to the variables related to the location of customers and the channels and means for delivering the goods and services to them. The first grouping of customers by their location can be done by dividing them into domestic and export. However, rather than emphasizing their physical location (which is also important) the division may be based on identification of homogeneous subsets of customers or potential customers. This type of grouping of customers is called market segmentation. It tries to arrange them according to the similarities of their needs and wants, their location and their importance to the supplying company.

Segmentation allows the company to make a decision as regards the coverage of the total market and on how to serve the customers most efficiently. Variables which need to be taken into account in segmenting the market usually include the following:

- Location of the customer
- Specific product performance sought by the customer
- Reliability sought by the customer
- Economic benefits sought by the customer
- Technical assistance sought by the customer
- Regularity in supply sought by the customer
- Volume of goods sought by the customer
- Nature of customer's operations
- Strategic importance of the product to the customer.

A precondition for segmentation is that the company has a clear policy on the level of entry to the market. For instance, a sawmill should decide whether it will serve wholesalers or whether it intends to reach some of the users of sawn wood directly and therefore compete with dealers.

Once the segments have been established, channels of distribution can be designed to provide the customers in each segment with goods and services in the best and most efficient way. Distribution covers both physical distribution, which includes transport and inventory of products, and the activities of middlemen such as agents, wholesalers and retailers who keep the products moving along the marketing channel to customers. In designing the channels of distribution, the specific features of industrial marketing have to be kept in mind. The channels should, therefore, be kept short to keep close contact with the customers,

allowing rapid identification of their specific needs for service, for specific product characteristics, and for information. The usually large quantities of product and the importance of the regularity and reliability of deliveries set specific demands for the logistics, i.e. the physical flow and stocks of goods.

2.6 Promotion

This category of marketing-mix variables is intended to deliver information on the availability of products and services, their relevant characteristics and conditions on which they can be made available to the customers. Marketing communication, which this function is also called, in addition to increasing awareness of the products and services, also aims to influence the attitudes of potential customers (make them more favourable toward the company). Finally, the company tries to influence the purchasing behaviour of the customer and lead him to buy. In summary, the purpose of communication activities in marketing is to move the customer from unawareness to buying.

The principal means of communication in industrial marketing include the following:

- Personal selling
- Participation in trade fairs
- Preparation of product literature
- Advertising
- Public relations and publicity.

The composition of the 'package' of means varies depending on whether the company wants to emphasize increasing awareness, or changing attitudes, or influencing buying behaviour. For instance, in the case of new products the aim may be to increase awareness while with the established goods the company may wish to influence attitudes.

Most communication function is company- and product-specific. However, in some cases it is advisable to carry out certain promotional activities in association with other companies. For instance, efforts directed at improving acceptance of products made of lesser-known wood species can provide benefits to several companies simultaneously. The same applies to efforts to make attitudes more favourable to building with wood.

2.7 Price

For many forest industry products, price level is determined by supply and demand in the international market. Therefore, the possibilities of individual producers' using price in the marketing mix as an independent variable are small. Indeed, oligopoly is a characteristic condition in most markets for forest products.

A certain flexibility in pricing exists, however, and reductions from list prices are often offered to meet competition. Such reductions can take several forms. There may be a straightforward discount to reduce the list price; or the terms of payment may be changed to more favourable ones; or the quality offered for the price may be better; or some extra charges may be eliminated.

Prices of forest industry products are very sensitive to cyclical variations in the overall economic activity. Price-cutting becomes common practice in a weak economy and actual market prices can be significantly below the announced list prices. Under normal conditions, it is customary to offer discounts to customers who take large quantities at a time. Another common type of discount is the functional discount offered to middlemen as reward for their services in the marketing channel.

A producer can try to get a premium on the price even of a commodity, if he can differentiate it by including service and using appropriate marketing channels.

Pricing can be either cost-based or value-based. The former starts from the production costs to which marketing and distribution costs plus a profit are added, while the latter uses the value of the product to the customer as its starting point.

3. MARKETING MANAGEMENT

This chapter will introduce the main elements of marketing management, all of which are also common to the other functional areas of management. The four classical elements include:

- Planning
- Organizing
- Leading
- Controlling.

In marketing management these are used to identify the quantity and quality the customer needs and wants and to develop products, services, prices and channels of communication in a mix which will meet needs and wants in the most resource-effective way. They are also used in efforts to respond to competition in a changing business environment.

Management takes place on several levels. Responsibility at the strategic level lies with top management although it involves all levels in the company. Management at operational level has the responsibility of converting the selected strategic alternatives into operational plans and taking action for their implementation. Management at administrative level plays a largely controlling role, as regards the allocation and use of the company's resources.

Distinction between the various levels of management is not always possible, nor it is necessary because there must be a close interrelationship among them to make the system work.

All these different levels contribute to the achievement of marketing objectives. The latter have to be in line with the objectives of the other functions of the company (production, finance, personnel, research and development) so that all contribute to the achievement of overall company objectives.

A strategic and integrated approach in management of a forest industry company is in general vital, because of the slowly maturing renewable resource base and the capital intensity. In the management of its marketing function, the need for close relationship with the buyers is another reason in favour of such an approach.

The sensitivity of the forest industry sector to cyclical variations in the economy sometimes compels the marketing management to opt for short-term measures which may seem to contrast with the strategic approach. It is therefore important to keep the objectives clearly defined so that they will not be confused with short-term tactical goals.

When an organized marketing plan is introduced it should start modestly. The plan should be flexible in both content and timing. At the beginning it may be restricted to only a part of the market. In every case, however, the plan should have the strong support of top management as regards both its design and implementation. It is also vital that the information system needed to support it be well developed.

Depending on the level of management, the time horizon varies. At the strategic level, plans cover long periods - in forest industries, anything beyond two years. Plans for some of the marketing mix variables can be longer than for some others. Operational-level management may deal with issues of up to two years' duration, but mostly they are less than one year.

3.1 Planning

The purpose of planning is to produce alternatives for setting objectives and selecting means of implementation. Planning therefore provides the basis for decision-making.

Planning is composed of three basic functions:

- Analysis and forecasting
- Setting up objectives
- Designing strategies.

For all these functions, it is important to set the limits within which each will be carried out. It is also important to establish the timing, procedure and organization of planning activities.

3.1.1 Analysis and forecasting

Analysis

Analysis comprises three time horizons: the past, the present and the future.

It tries to identify the patterns of change. The changes may be even, cyclical or a change of level.

Continuous and systematic analysis helps management to notice the signals of change early enough to react, i.e., to modify the marketing mix in order to meet the changing conditions in the market.

Analysis is needed to identify changes in both the company's own strengths and weaknesses in marketing and changes in the business environment in which the company operates. The strengths and weaknesses are related to the market share of the company's products and services and to the effectiveness with which individual marketing mix components are applied. Analysis of the external business environment tries to identify any changes taking place in the market which could pose threats to the company's share of the market or to its effectiveness in applying the marketing mix. It also tries to identify opportunities in the market. Analysis of the competition is an important part of analysis of business environments. Changes in the business environment can be social, economic, technical, political or legal.

Analysis requires a continuous flow of reliable data and information, and a method. An efficient data-collection system must be available. Data requirements must be defined in detail at all levels of planning, appropriate data sources must be identified and efficient data storage and retrieval systems must be developed.

The commonest way to analyse the external business environment of forest industries is to base analysis on economic indicators such as GDP, industrial production, housing starts and private consumption. Detailed market analysis evaluates changes in the customer industries, whether they are economic, social or technical. In the market for forest industry products, quality and service offerings need to be under continuous scrutiny because they are the marketing mix variables most commonly used by competitors to try to differentiate their total offering.

Methods of analysis can be either quantitative, qualitative or a combination of the two. The availability of data often sets limitations on the use of sophisticated statistical methods in the analysis of markets for forest products. This is especially so in many of the developing countries. The lack of adequate quantitative data often means that analysis has to be based on expert opinions and information collected from customers, competitors and the authorities. This may require the use of specialized marketing research services which have easier access to such sources of detailed data than a representative of a competing company.

Forecasting

It is not enough to evaluate the past and the present. It is more important to know what the future may bring. Planning periods should be established based on two principal criteria:

How far ahead it is possible to foresee.
How far ahead it is necessary to foresee.

It is especially important that the quantities which a company will be able to place in the market be known in advance. In forecasting future sales, attention should be paid to the selection of appropriate sales forecasting methods in order to get estimates which are as reliable as possible.

Factors which need to be taken into account in selecting sales forecasting methods include the following:

- Stage in the product life-cycle:

  Business analysis stage
  Market testing stage
  Introduction and growth stage
  Maturity stage

- Accuracy needed; this is a function of:

  Time horizon
  Cost

- Availability of data

- Availability of time

Several approaches to sales forecasting should be used because

(a) No single method is completely fool-proof;

(b) The forecasting problems of each approach differ in terms of:

  Products
  Time horizon
  Accuracy needed
  Availability of data
  Availability of time.

Sales forecasts can be prepared annually, semi-annually, quarterly, monthly or at other intervals. The commonest practice is to prepare annual or quarterly forecasts, but they have to be revised more frequently. Although it would be useful to have sales forecasts by detailed product categories, in practice the cost of this work often restricts the forecasts to an aggregate level only.

3.1.2 Setting objectives

Analysis provides the framework for setting realistic marketing objectives as regards the market segments, market shares in each segment and the use of marketing mix variables to cope with the competition. The objectives have to be clearly defined. They need to be quantifiable, have time limits and show the responsibilities of the people involved in achieving them.

Marketing objectives have to be in line with the company's overall objectives and those of the other functions. Objectives are needed in marketing for the following areas:

- Size of the total market to be covered;
- Market entry level;
- Customers to be reached;
- Segments to be covered;
- Market shares to be reached;
- Variables in the marketing mix to be used (product, price, channels, communication, service).

3.1.3 Designing strategies

To reach the objectives set, an array of strategies will be required. These are formulated by building up a harmonized marketing mix from the main variables. The structure of the marketing mix depends on the segment of customers which will be served by the company. For instance, newspaper publishers need the regularity and reliability of supply and evenness in the quality of newsprint - "printability" and "runnability" as required by their printing presses. Offset printing presses require specific surface resistance to "picking" while opacity is one of the main characteristics required in letterpress. Therefore, these two market segments have to be served with products of different characteristics although both demand printability and runnability.

Although both the furniture industry and building industry buy sawn wood, their wants differ considerably as regards the product characteristics, size of orders, regularity of supply and product information.

Maturity of the product is an important factor in the selection of marketing strategies. Most markets are composed of products at different levels of maturity. In the domestic markets of developing countries, forest industry products are still in the initial or growth stages, with maturity far ahead. The same products in the export markets of industrialized countries may already have reached maturity or be very close to it.

The marketing mix composition used by competitors must be followed to allow the company to respond to any innovations or changes which the competition may be trying to introduce into the market.

3.2 Organizing

In the organization of a company's marketing functions several forms can be identified, depending on the company's stage of development. Kotler has identified five stages in the evolution of marketing organizations which relate to different stages in marketing philosophies, as follows:

1. Simple sales department
2. Sales department with ancillary functions
3. Separate sales and marketing departments
4. Modern marketing department
5. Modern marketing company.

Typical of the first is that it is in charge of sales only. Occasional market research and advertising functions are carried out by the sales vice-president who reports to the managing director.

In the second stage, the sales vice-president is assisted by the marketing director who will manage a team of specialists dealing with advertising, marketing research and customer service.

The third stage will have both a sales vice-president and a marketing vice-president reporting to the managing director. Sales and marketing are supposed to work together, but may not always do so.

In a modern marketing department, the marketing vice-president is in charge of the whole marketing function, including the sales force which reports directly to him/her.

The modern marketing company concept is applied in only a very few cases. In such a company, the marketing vice-president is the authority over other business functions. The purpose of such an arrangement is to emphasize a company-wide customer orientation.

Within the marketing function, further organization may be done of the following:

- Functions (marketing research, business communications, customer service, market planning, product development, sales);
- Geographical units (this is used to organize the sales function by regions, zones and districts);
- Products (these are criteria for subdivision used in organizing the sales force);
- End-use markets (applied in large companies with a highly diverse set of markets. The market managers are responsible for developing long-range and annual plans for sales and profits in their segments.)

A full range of organizational patterns can be found in forest industry companies. The simple sales department approach is common in small companies whereas the modern marketing department is becoming increasingly common in larger companies with wider product ranges. The division of marketing by functions is the commonest form of marketing organization. Companies (usually the largest and most advanced in the sector) which have divided their businesses into strategic units, organize their marketing management according to markets, not in the geographic sense but according to similarities in the customers' needs and wants.

Organizing can also be understood to include establishment of staff requirements and selection of staff which is carried out in close collaboration with the personnel management.

3.3 Leading

Leading is the management function which deals with people. In marketing management, the sales force is the largest group of people and needs strong leadership, especially to encourage its motivation for achieving the targets set.

The other functional specialists in marketing require a different leadership approach. Emphasis on a standard of performance is less important to them than to the sales force. They need rather clearly set objectives and policies in order to perform.

Leading as a function of marketing management includes the following main activities:

- Interpreting and enforcing the overall company policies;
- Setting up goals and standards of performance for marketing staff;
- Creating a working environment and conditions appropriate for effective performance;
- Securing adequate resources for achievement of marketing objectives;
- Identifying staff development requirements and providing appropriate continued training opportunities;
- Establishing, according to company policies, adequate compensation plans to provide incentives which will stimulate and motivate the marketing staff;
- Stimulating and facilitating communications

  (a) among the marketing staff; and
  (b) between the marketing and other functional areas of the company.

Many of the general principles of personnel management discussed in other presentations are relevant to this specific management function and will provide further details for understanding the role of leadership in marketing management as well.

3.4 Controlling

The fourth main element of management is controlling. This means the comparing of results achieved with the targets established. Any deviation will result in a need for analysis to find out the reasons and for taking corrective action.

In the marketing control process, four main types can be distinguished:

(a) Annual plan control
(b) Profitability control
(c) Efficiency control
(d) Strategy control

3.4.1 Annual plan control

In annual plan control, the management examines whether the results are being achieved as planned. This is done by means of several approaches such as sales analysis, market share analysis and sales-to-expense analysis.

3.4.2 Profitability control

The purpose of this is to discover where the company is making or losing money. A system has to be established to find out profitability by product, customer, segment, channel of distribution and size of order. This will help the marketing management to modify its activities in order to improve the profitability of efforts.

3.4.3 Efficiency control

The efficiency of the sales force, the physical distribution system, promotional measures such as advertising and sales promotion, and other marketing activities have to be kept under continuous control. Efficiency control, therefore, tries to evaluate and improve the impact of marketing expenditures.

3.4.4 Strategy control

The changes taking place in the marketing environment are rapid. The company has therefore to evaluate its strategic position from time to time to find out whether it is taking full advantage of opportunities offered in the market-place and whether there are any emerging threats for which the company has to prepare itself.

Strategy control needs to be designed to cope with these issues. Marketing audits and reviews of marketing effectiveness are tools in strategy control. Prime responsibility for it lies with top management as well as the marketing personnel.

4. CONCLUDING REMARKS AND SUMMARY

Forest industry companies are resource intensive and therefore it is very difficult to introduce drastic changes in them. Nearly all mills are designed individually to adapt to local conditions. Once adapted, technology in a mill can be changed only with great difficulty and at high cost.

Another factor which limits the possibilities of any drastic change is the raw material base. Forest resources which are available to an individual mill have certain fixed characteristics which cannot easily be altered and also determine the range of products the mill can produce.

The marketing function of such companies has to take into account, simultaneously with the needs and wants of the customers, the characteristics of the company's resources.

The strategic marketing approach would therefore seem to be the most appropriate philosophy on which to base marketing activities.

Preconditions for a strategic management approach, comprising marketing, include the following:

- The company's objectives must be clearly defined and include the objectives of individual functions as integral parts;
- Policies for selecting and implementing strategies must be clearly defined;
- Strategies for achieving the objectives must be formulated with full participation of all functional areas of the company taking due account of the specific strengths of company resources;
- Top management must commit itself fully to this approach;
- Adequate management information systems and methods of analysis must be set up to monitor changes in the business environment;
- Operational-level staff must fully understand the objectives and selected strategies and policies and commit itself to convert them into operational plans and action.

Forest industry products are almost exclusively semi-processed goods sold to other industries and other institutional customers. In marketing these products, the special characteristics of industrial marketing must be recognized. An especially important feature in this respect is the close and long-lasting buyer/seller relationship which must be continuously maintained and developed.

Use of marketing mix variables depends on the market segments to be served. Therefore, the segmentation process should be carefully carried out. This calls for thorough market and marketing studies by specialists who should have at their disposal well-established data collection and analysis systems within the company. Companies have at their disposal the following individual marketing mix variables:

- Quality
- Service
- Channels of distribution
- Communication.

All these can be used in building up a marketing mix which can be used to differentiate the offering of the company from that of its competitors. The price variable is very often set by supply and demand. It cannot be freely used by individual forest industry companies as an independent variable except in very few exceptional cases in which what the company offers is distinctly different from the offerings of its competitors.

In using the variables of quality and service, an especially close collaboration must exist between the marketing, production, research and development, and forestry departments of the company. This presumes a well functioning communication system within the company as well as between the company and its customers. Short channels of distribution with direct contacts between the company and its customers rather than through several layers of middlemen are preferred.

The task of marketing management is to make all this work efficiently. This requires careful planning based on thorough analysis of data and information which should be as comprehensive as can economically be made available. Short-term tactical measures should be in harmony with longer-term strategic measures. This is achieved by making the company objectives, policies and strategies known to the operational staff. The best way to do this is to involve the latter in setting objectives and identifying policies and strategies in their own fields of specialization.

Organization of the marketing function must be compatible with the marketing approach adopted. In forest industry companies either a modern marketing department or a modern marketing company depending on their size, seem to be the most appropriate forms of organization.

Leading is probably the most demanding function of any management. In marketing, it is the means of keeping the marketing function in action by providing the environment and resources for effective performance of the marketing staff; by providing for continuing staff development with particular emphasis on sales staff development; by setting goals and standards, for instance as regards the targets for market shares in each segment and the budget limits for achieving them. Related to leading is the controlling function of marketing management. It has to evaluate continuously to discover whether the marketing function is doing the right things correctly and using resources efficiently. The future earning potential of the company depends greatly on the ability of the marketing unit to identify long-term market opportunities, and threats, early enough. The profitability of the company is improved when the marketing unit uses resources efficiently and the vital long-term relationship with customers is guaranteed when marketing functions are performed correctly.

Last, but by no means least, it should be pointed out that marketing management is a fast-moving function in any company. The cycle of planning-organizing-leading-controlling revolves continuously and its parts are tied together by quick decisions.

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Demonstration of safety clothing and personal protective equipment used by Finnish forest workers
(Photo: H. Seppanen)

Mobile sawmilling at the Palvaanjarvi training centre
(Photo: M. Heikurinen)

Bundled logs and pulpwood in water storage area
(Photo: H. Seppanen)

ACCOUNTING AND COST CONTROL

by

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Jaakko Pöyry Oy

1. MANAGEMENT AND FINANCIAL ACCOUNTING

1.1 General

A business enterprise must have a formal bookkeeping system which registers monetary events in a way demanded by local law. The bookkeeping system usually has at least the following main parts:

- A system to notify and record the payments into and out of the company's treasury;
- An event-classification and internal control system to give structure to the recording. This kind of system consists of specified ledgers, double entry bookkeeping account-structures, as well as the procedures and rules used in closing the accounts and auditing the books;
- Asset and liability registers and write-off policies;
- Reporting procedures, such as annual statements and reports.

This minimum system might be sufficient as long as the enterprise is small, the business simple, the owner himself is head of the enterprise, and the outside financing is kept to limits which can be guaranteed by the owner's personal property.

If one or more of these limitations is overrun, a more advanced accounting system is needed, a system which can give more assistance in managing the firm.

1.2 An accounting system defined

An accounting system is a formal means of gathering data to aid and coordinate decisions in accordance with the overall goals or objectives of an organization.

An effective accounting system provides information for three purposes:

- Internal reporting to managers for use in planning and controlling routine operations;
- Internal reporting to managers for use in strategic planning, making special decisions and formulating overall policies and long-range plans;
- Reporting to stockholders, government and other parties outside management.

An accounting system is often described as being two slightly overlapping systems: a management accounting system, and a financial accounting system. The main distinction is in the uses of accounting. A management accounting system mainly serves the two first purposes above, while financial accounting serves the third one. Another distinction is that management accounting makes a functional analysis of the data (costs

to manufacture product A or product B, for example), whereas financial accounting analyses the revenues, expenses, the funds and debts according to the types of transactions made.

A common basic recording system is usually used to compile the fundamental data for both systems. The differences are in processing or summarizing the data and in reporting them. The reason for these differences is the different ways in which the information is used.

Fig. 1 describes the main material and financial flows in a manufacturing enterprise. The main area, where operations management can influence the profitability of the firm, lies above the dotted line. It is this area which covers management accounting.

The monetary transactions are shown below the dotted line. These functions also have an effect on the overall profitability but, from the operations management's viewpoint, the most interesting feature is the fact that this monetary process and accumulation of funds either gives management the freedom to run the production in a desired way or it sets some financial limits to it.

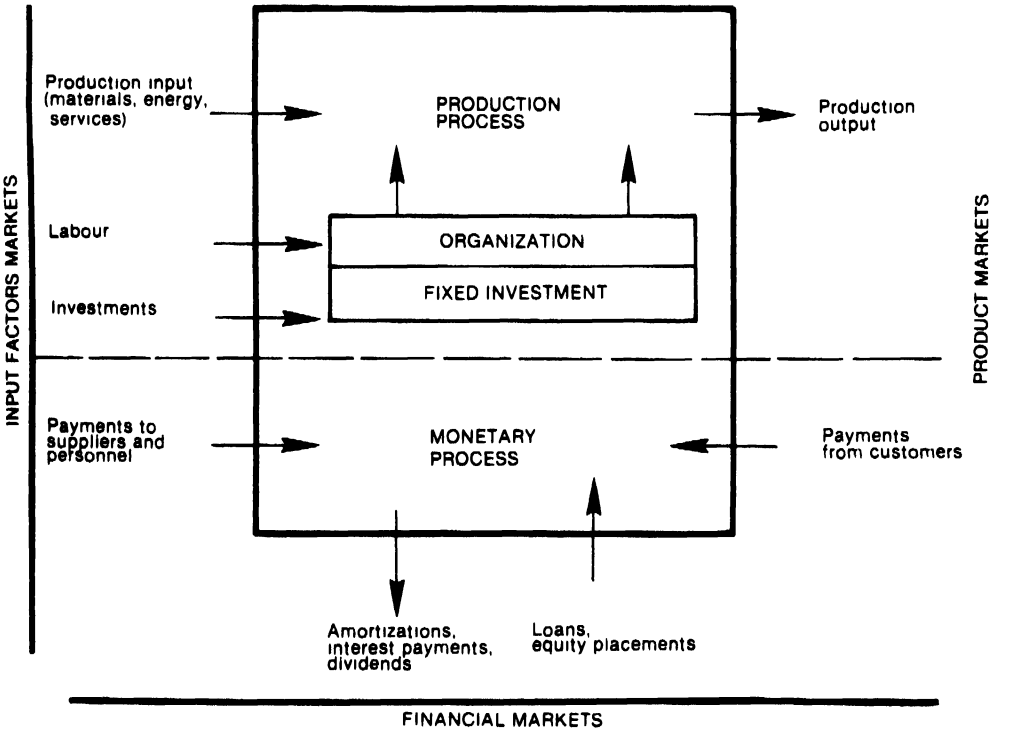


Fig. 1 A BASIC MODEL OF A MANUFACTURING ENTERPRISE

The monetary transactions are described in the company's financial accounting. These transactions are done with parties outside the company.

In most countries, there are strict rules for the forms and conventions of financial accounting and reporting. These rules are needed because some reports from financial accounting are usually given to the tax authorities, debtors and the public. The financial accounting records can also be used as evidence in cases of legal conflict. Therefore there is public interest in having a common bookkeeping system.

In management accounting these rules are not valid because no external authority can order a company on how to report to its own managers. It must be kept in mind, however, that having individual conventions for internal data demands in a company means that two sets of records are needed instead of one. This leads to additional costs. Therefore, it is advisable to keep the management accounting procedures similar to those of financial accounting.

1.3 Nature of planning and controlling

The nucleus of the management process is decision-making: to choose from a set of alternatives a course of action to achieve some objective. These decisions are routine (making tenders, accepting orders, making daily production schedules) or non-routine (annual planning, investment planning, altering the product range). Decision-making is an essential part of the planning and control cycle. Fig. 2 shows the planning and control cycle and its connection to internal accounting.

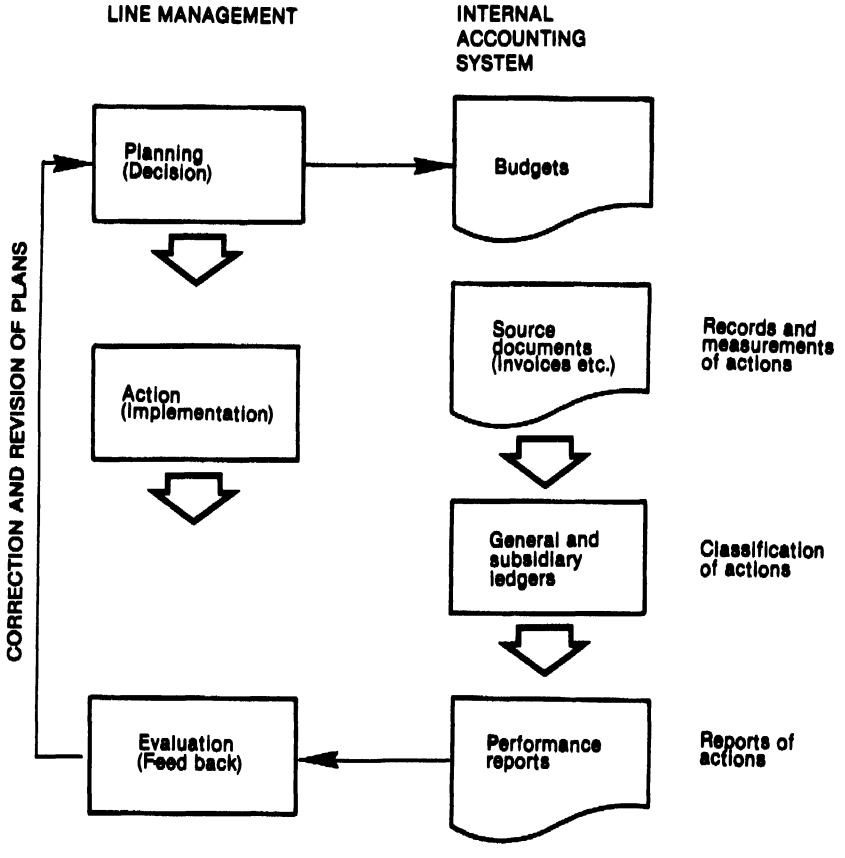


Fig. 2 INTERNAL ACCOUNTING SYSTEM CONNECTED TO PLANNING AND CONTROL

1.4 An illustration of the profitability budget and performance report

Local Mills Inc. has a sawmill with an annual capacity of 21 000 m^3 of sawn timber. The budgeted income statement of the mill for the year 1983 is shown in Table 1.

Table 1

LOCAL MILLS INC.
BUDGETED INCOME STATEMENT FOR 1983

Sales volume, m^3	20 000
Sales income	1 600 000
Variable costs of goods sold	960 000
Contribution margin	640 000
Fixed costs	380 000
Operating margin	260 000

As actual revenues and costs are incurred during the year, they are classified and recorded in the ledgers.

Performance reports are made monthly or quarterly. In practice the reports may be very detailed and contain explanations of variations from the budget. An example of a brief performance report is shown in Table 2.

Table 2

LOCAL MILLS INC.
INCOME STATEMENT 1983

	Budget	Actual	Variance	
Sales volume, m^3	20 000	18 000	2 000	U
Sales income	1 600 000	1 458 000	142 000	U
Variable costs of goods sold	960 000	873 000	87 000	F
Contribution margin	640 000	585 000	55 000	U
Fixed costs	380 000	370 000	10 000	F
Operating margin	260 000	215 000	45 000	U

U = unfavourable
F = favourable

In performance reports attention is paid to the variations from the budget. It is through management's investigation of these variations that improved methods are discovered. While the budget is an aid to planning, the performance report is an aid to controlling. The accounting system does not control - that is done by managers. Accounting assists the management by providing measurement of actions and by pinpointing the variations.

It should be noted that production budgets and control reports should be done using both the actual quantity figures and the corresponding monetary values of the main input and output factors. The minor items can be recorded and reported as monetary costs only. The use of real quantitative values makes the targets, performance figures and differences more understandable to most managers, and also helps in distinguishing differences due to price variations.

2. COST AND PROFITABILITY ACCOUNTING

2.1 The contents of cost and profitability accounting

Originally the term "cost accounting" referred to ways of accumulating and classifying historical costs for products and departments, primarily for inventory valuation and income determination. It has since grown to become a wider process, which is not limited to accumulating and classifying historical costs. Cost and profitability planning is combined

with control. In practice all cost accounting in an industrial enterprise should be arranged so that it touches on and assists the planning and decision-making of the management.

The field of cost accounting is clearly shown above the dotted line in Fig. 1. Its duty is to register all the events in the production process and to put economic values on them. While putting values on the events, there is no need to be as exact as in formal bookkeeping. Standards and approximations can be used where convenient. Of course, some control calculations must be made to ensure that approximations do not lead to erroneous conclusions.

While profitability is calculated, there are two major alternative methods to calculate the income to be compared with the costs:

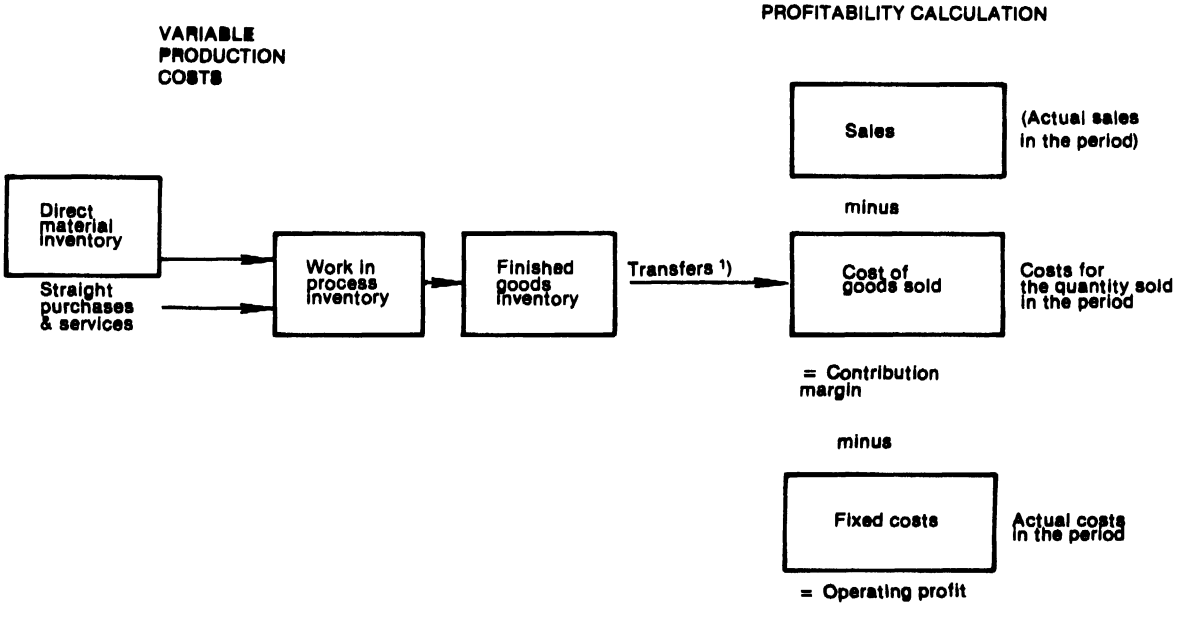
(i) The periodic income is measured according to the sales in that period, from which the cost of products sold is then subtracted.

(ii) The periodic income is expressed as the forecast sales value of the production in that period, and the production costs in the same period are subtracted from it.

Both methods give the same result in the long run. In short-term calculations, there will be differences due to fluctuations in the quantity of stock.

It cannot be said that one of the methods is more or less correct than the other. Usually it is more convenient to choose the method which is most similar to the bookkeeping conventions of the country.

In this paper, the former method (i) is used in all the examples. The cost formation of products sold for the profitability calculation is shown in Fig. 3.



1) In this diagram it is assumed that the finished goods inventory is valued according to the variable production cost.

It would be equally correct to add some fixed costs to the production cost as a factory overhead cost. If this is done an analogous amount must be excluded from the fixed costs in the profitability calculation.

Fig. 3 THE COST FORMATION OF PRODUCTS SOLD FOR THE PROFITABILITY CALCULATION

2.2 Manufacturing costs

Some definitions:

Cost is the resources given up to achieve a particular purpose.

Cost objective is the activity on which the separate measurement of costs (for example, the department, production and production line output costs) is desired.

When manufacturing costs are calculated, the cost accounting system typically accumulates costs by some natural classification, such as wood raw materials or energy, and allocates these costs to cost objectives.

Fig. 4 shows an example of the allocation of costs, via two production lines' accounts, of products coming into storage.

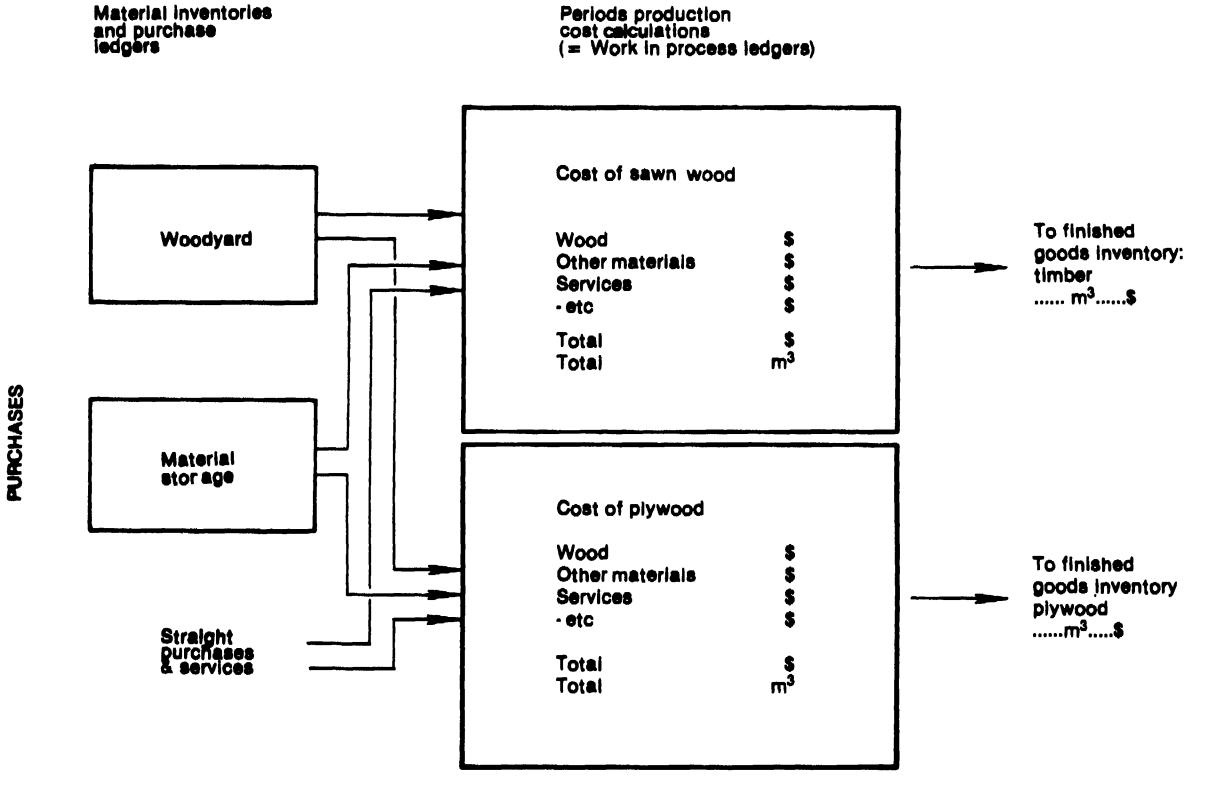


Fig. 4 AN EXAMPLE OF THE ALLOCATION OF COSTS OF PRODUCTS COMING INTO STORAGE

Manufacturing costs can be classified as follows:

- direct materials	(Variable cost	(
- direct services	(or	(
- direct expenses	(prime cost	(Total
		(manufacturing
- indirect materials	(	(cost
- labour	(Overheads	(
- indirect services	(	(
and expenses	(	(

The classification above is a logical one in process production, such as in a sawmill or a mill manufacturing standard plywood. In a more varied production process where the products differ in labour intensive-

ness, there is a need to take a share of the labour cost into the product prime cost. The cost of labour is then apportioned into direct and indirect costs.

The costs of direct materials, services, etc. are those which are clearly identified with the manufacture of the particular product. The same clear identification is also characteristic of direct labour in cases where it is taken into prime cost.

Overheads represent the expenditure incurred in the provision of business facilities required for production to take place. Overheads are usually calculated in order-production or in multiproduct production (such as furniture or joinery products), where there are clear differences in the way different products use the capacity. Some examples of these kinds of cost could be:

- lubricating and service of machinery
- cleaning
- maintenance of buildings
- production administration.

2.3 Variable costs and fixed costs

Variable and fixed costs are usually defined in terms of how a total cost changes in relation to fluctuations in the activity base. In manufacturing companies the activity level is usually production volume.

If activity level increases:

Type of cost	Total cost	Cost per unit
Fixed cost	No change	Decreases
Variable cost	Increases	No change

It must be noted that these concepts - variable or fixed costs - are only simplifications. It may be difficult to classify a cost as exactly variable or exactly fixed. But exactness is not necessary. What is needed in normal cost accounting, for assisting management with planning and controlling the production activities, is the possibilty to analyse the effects of moderate changes in activity levels. An example of the cost-volume relationship is shown in Fig. 5.

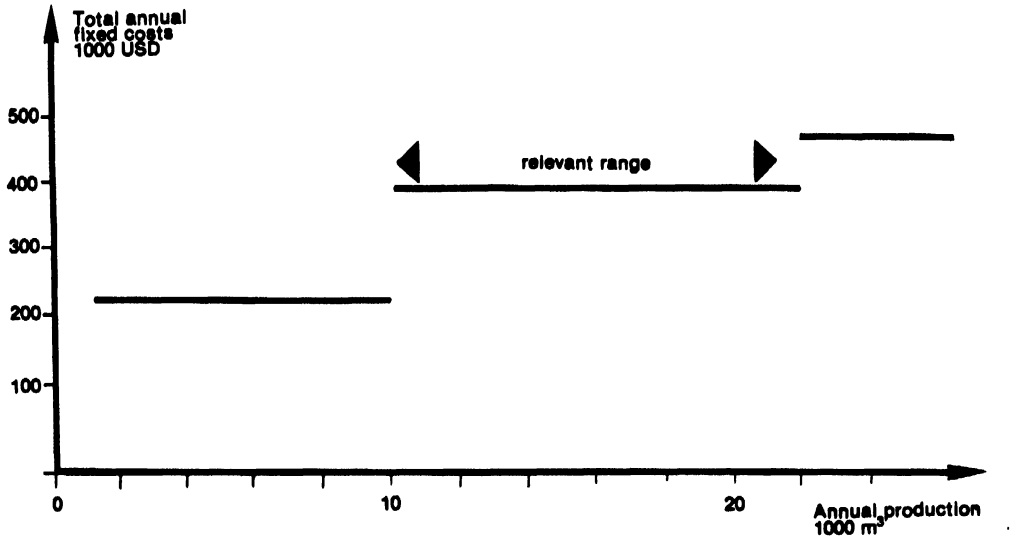


Fig. 5 FIXED COSTS IN VARIOUS PRODUCTION VOLUMES

In the figure, the fixed cost is shown as US$400 000 a year, while in fact this sum is relevant only when production volume is in the range of 10 000-21 000 m^3 a year.

Similarly, a variable cost/unit stays constant only in a certain range. Using an example for sawmills, the log transport distance will probably lengthen when the required quantity of logs increases, and thus the cost of logs/m^3 will rise slightly. Even in this case, there is quite a wide relevant range in production volume within which the cost/unit remains stable.

The managers must know the company's cost behaviour in order to predict the effect of their decisions on profits.

2.4 Cost-volume-profit relationships

Cost-volume-profit analysis is also called break-even analysis. The term comes from the point of zero profit.

The break-even point is represented by the intersection of the sales line and the total cost line shown in Fig. 6.

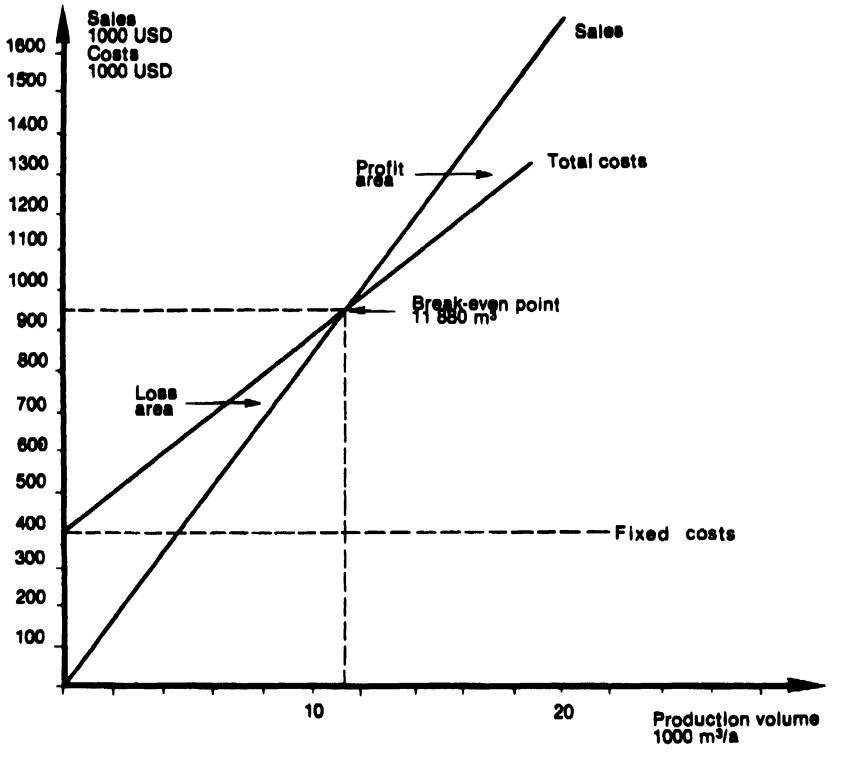


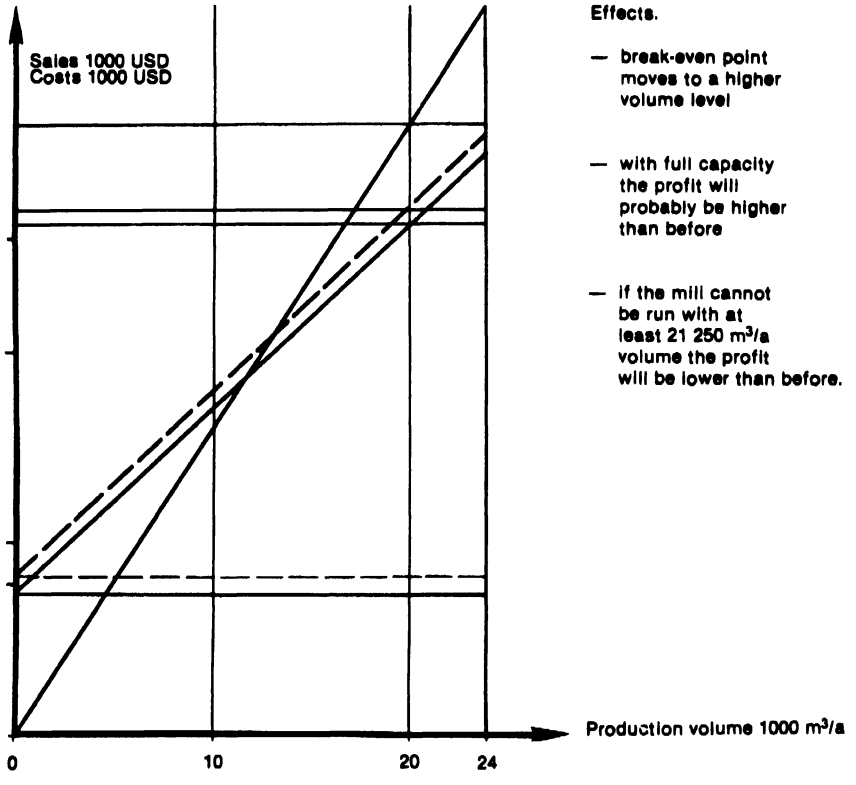
Fig. 6 BREAK-EVEN GRAPH

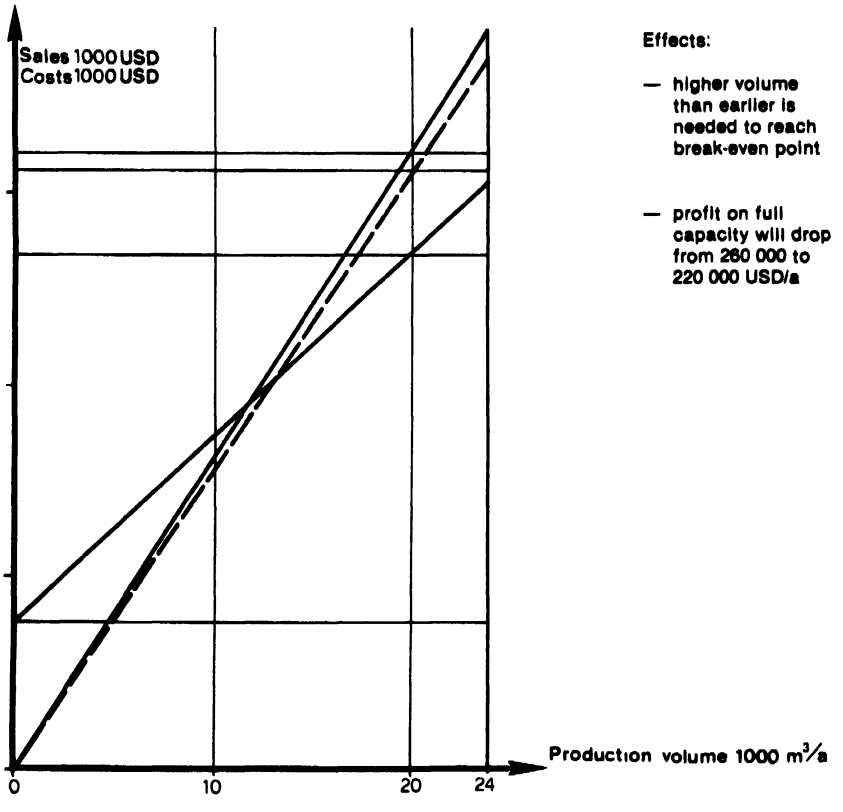
The graph shows the profit or loss and any rate of activity within the limits of the relevant range. Such a graph is useful for studying the effect of changes in the variables.

Graphic examples of cost-volume-profit analysis are shown in Figs. 6A and 6B.

1. The sawmill can expand its capacity to 24 000 m^3 per annum. This makes the fixed cost US$420 000 per annum instead of the present US$380 000 per annum. The new situation is shown as dotted lines in Fig. 6A.

2. It seems that the sales price is dropping to US$78/m^3 from the present US$80/m^3. The new situation is shown as a dotted line in Fig. 6B.





Figs. 6A and 6B GRAPHIC EXAMPLES OF COST-VOLUME PROFIT ANALYSIS

3. PLANNING AND CONTROL OF FINANCES

The purpose of planning and control of finances (financial management) is to keep funds flowing so that no essential management decision is frustrated by lack of purchasing power. To achieve this, reports to management are needed on the financial position of the firm, on anticipated changes in it, and on policies to be used when there are unexpected calls on the treasury.

The formal financial plan provides for the expected charges. This is the easy part of financial management. The more difficult part is to prepare for the unexpected. In practice, this usually means selecting a time for settling unexpected charges. The firm must have a policy for financial mobility and the easiest one is to have some ready money in cash. A more sophisticated policy is prepared first by trying to analyse the kinds of risks which exist. Then the availability and attainability of resources are checked. Some examples of possible resources for financial mobility are listed below:

Instant reserves
- surplus cash
- unused line of credit

Negotiable reseves
- new bank loans
- new equity capital

Reduction of outflow
- change in production volume
- diminishing overhead expenses

Allocation of outflow timing
- postponement of payments

Liquidation of assets
- diminishing storage space
- shutdown of some lines
- sale of business units.

4. TYPICAL CALCULATION SHEETS OF COST ESTIMATES

Average net cost of wood

	Consumption m^3s/m^3, Adt[1/]	Unit price US$/$m^3s$	Cost US$/$m^3$, Adt
Export logs	1	60.0	60.0
Sawnwood			
- roundwood	2.10	100	210
- credit for pulp chips	0.77	80	-62
Net cost			148
Plywood			
- roundwood	2.33	100	233
- credit for pulp chips	0.61	80	-49
Net cost			184
Pulp			
- roundwood	3.50	80	280
- pulp chips	0.59	80	47
Net cost			327

1/ m^3s = m^3 sawn wood

Variable costs: sawmill
(Typical year)

Item	Unit price	Consumption	Cost
	US$/unit	unit/m^3	US$/$m^3$
A1 Wood			
- roundwood	100	2.10	210
- credit for pulp chips	80	0.77	-62
			148
A2 Chemicals			
- paint	10/l	0.17	2
- miscellaneous			5
			7
A3 Purchased energy			
- fuel oil	1 000	-0.005	-5
- fuel for vehicles	1 500	0.0014	2
			-3
A4 Packaging			
- wood			own
- steel bands			5
- plastic and paper			20
- marking materials			1
			26
A5 Others			10
TOTAL VARIABLE COSTS			188

Variable costs: plywood mill
(Typical year)

	Unit price	Consumption	Cost
	US$/unit	unit/m^3	US$/$m^3$
A1 Wood			
- roundwood	100	2.33	233
- credit for pulp chips	80	0.61	-49
			184
A2 Chemicals			
- PH mix 75%	2/kg	0.75 x 110	165
- UH mix 25%	1/kg	0.25 x 125	31
- miscellaneous			5
			201
A3 Purchased energy			
- fuel oil	1 000/t	0.12	120
- fuel for vehicles	1 500/t	0.002	3
			123
A4 Packaging			
- steel bands			20
- wrapping materials			40
- other material			20
- sawnwood			6
			86
A5 Other variables			20
TOTAL VARIABLE COSTS			614

Fixed costs

B1 Personnel costs, incl. fringe benefits

- production
- maintenance
- services
- out of site personnel
- management and administration

B2 Materials

- maintenance and repair materials
- operating supplies of fixed type (replacement investments are elsewhere)

B3 Personnel-related other costs

- subsidies
- transport
- training and recruiting

B4 Other fixed costs

- fixed electricity charge
- water, effluent

B5 General overheads

- mill overheads
- head office
- insurances
- knowhow partner
- miscellaneous

Annual net working capital: sawmill

Inventories	Size of inventory	Net working capital requirement
	weeks	% of annual cost
Wood (included in forestry cost)	-	-
Chemicals	8	15
Fuel oil	4	0
Other variables	8	15
Lumber in drying	12 x 42%	23 x 0.42
Finished products in store	4	8
Operating supplies	12	23
Maintenance materials	26	50
Accounts receivable	4	8 of sales
Accounts payable	2	-5 of cost

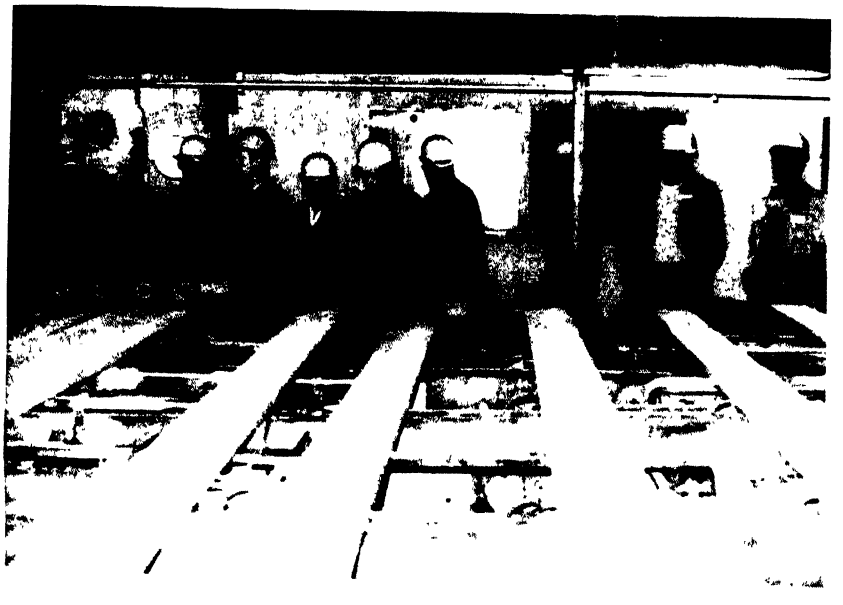
Annual net working capital: plywood mill

Inventories	Size of inventory	Net working capital requirement
	weeks	% of annual cost
Wood (included in forestry cost)	-	-
Chemicals	8	15
Fuel oil	4	8
Other variables	8	15
Finished products in store	4	8
Operating supplies	12	23
Maintenance materials	26	50
Accounts receivable	4	12 of sales
Accounts payable	2	- 5 of cost

Annual changes in working capital: plywood mill

Year	Production	Working capital	Cumulative
	m^3/a	1 000 US$/a	
1984	-	-	-
1985	32 600	3 900	3 900
1986	73 400	3 200	7 100
1987	81 500	800	7 900
1988, etc.	81 500	-	7 900

Infeed of cant using laser for guidance
(Photo: H. Seppanen)



Final end-trimming of dry boards (Photo: H. Seppanen)

PERSONNEL MANAGEMENT

by

Friedrich Blanz and Harri Pelkonen
F. Blanz & Co. Oy Training Consultants

1. CONCEPT OF PERSONNEL MANAGEMENT

The concept of personnel or manpower management includes all planning and control of labour force, supervisors and management-level personnel. The responsibility of personnel management is shared between the line managers and personnel department or personnel manager.

The skills, capabilities and motivation of personnel are always key factors when high production and good results in industry are considered. The growing demand for personnel from the point of view of technical development usually means a smaller number of workers but more skills for each individual. The growing demand from the point of view of profitability means higher levels of managerial skills, responsibilities and power in decision-making (Fig. 1).

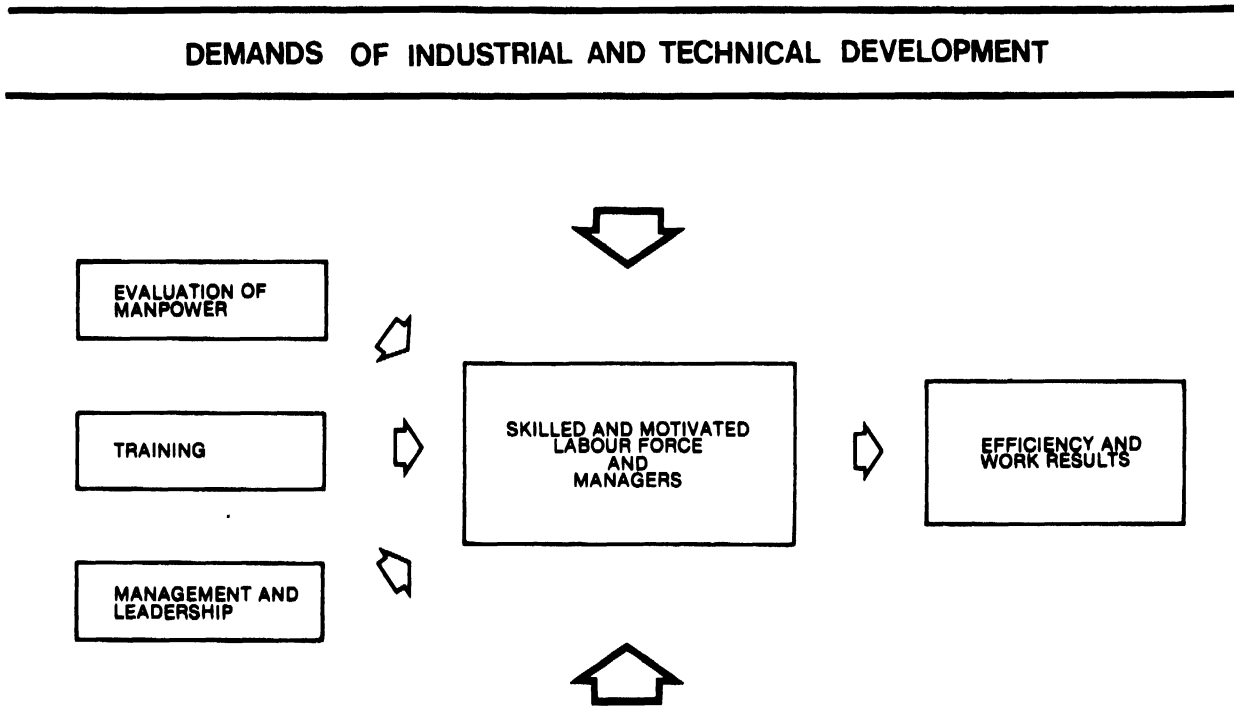


Fig. 1 KEY FUNCTIONS IN DEVELOPING PERSONNEL

The key functions in developing personnel to meet these requirements are the following:

- evaluation of manpower
- training
- management and leadership.

Analysis of manpower management in more detail may include the following functions:

- personnel planning
- selection and recruitment
- salary administration
- orientation of newcomers (safety)
- training
- supervising and leadership, with participation included
- internal information
- social and health services.

All these functions have their own systems and policies. In many companies these rules are in written form - a system which is called personnel policy (Fig. 2).

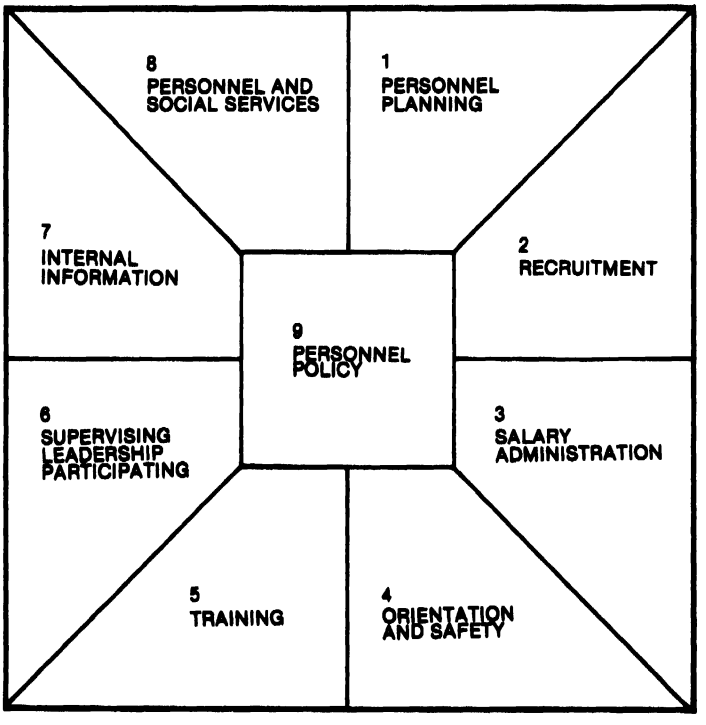


Fig. 2 TASKS IN PERSONNEL MANAGEMENT

Most of the functions listed above have been used, especially for personnel at the worker level. The industrial worker is usually well aware of most of these functions and knows how they are used to fulfil his own needs. At the same time they help the company to reach its goals and profit margins.

For the managerial level, most of these functions have the same meaning as for the workers' level. However, the managers should also be interested and motivated by some other factors. The personnel management activities which develop the efficiency and attitudes of the managers are listed below and illustrated in Fig. 3:

1. Development of skills
2. Feedback
3. Rewarding wage systems
4. Work environment
5. Internal information
6. Effective organization
7. Right selections
8. Planning and control systems.

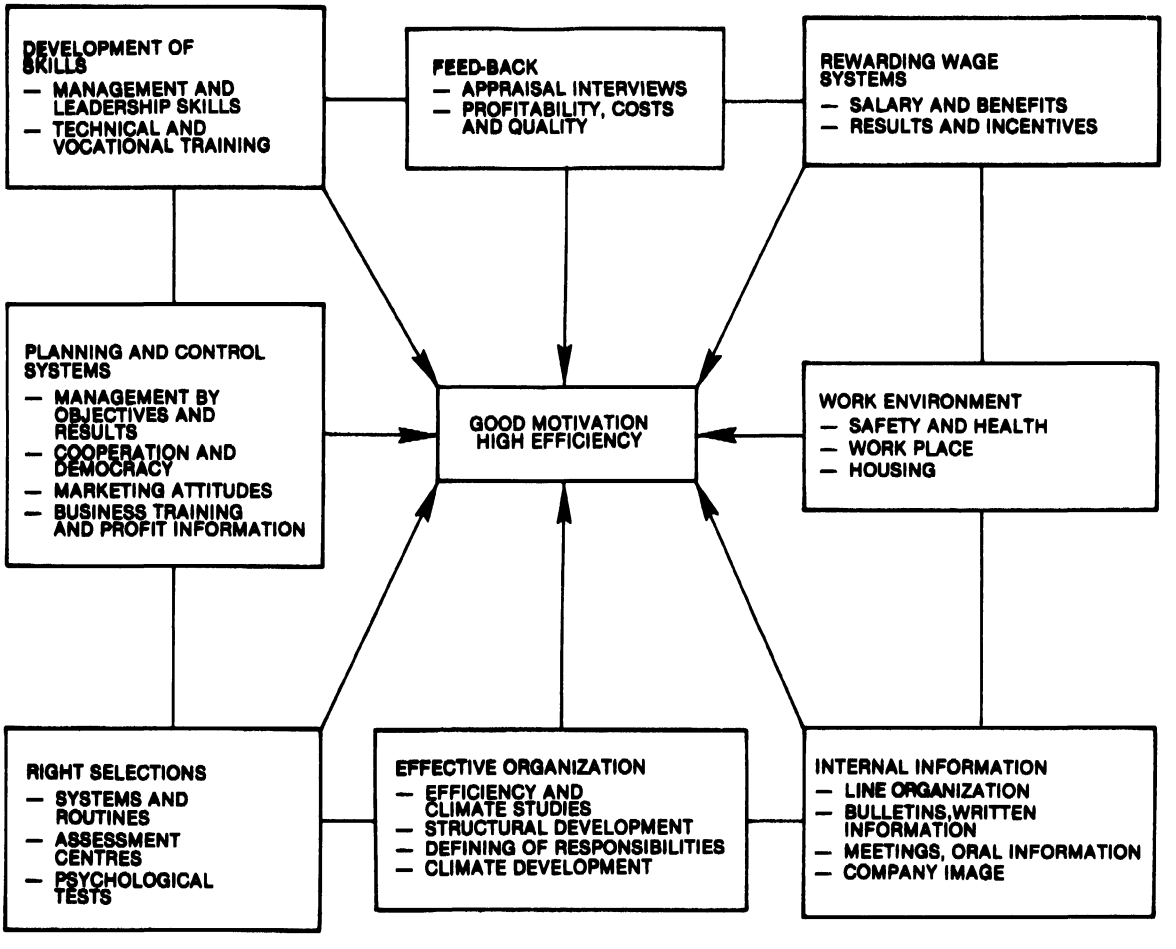


Fig. 3 THE BUSINESS OF PERSONNEL MANAGEMENT IS THE OPTIMUM USE OF HUMAN RESOURCES

In the following sections most of the personnel management aspects for both worker and managerial levels are covered.

2. MANPOWER PLANNING AND BUDGETING

2.1 Planning process

The objective of personnel planning procedure is to ensure, in advance, that the company will have the following:

- sufficient numbers of employees
- adequately qualified employees
- at all times
- in line with the actual needs

in order to ensure that:

- each job is manned by a person with the required abilities;
- each employee has a job in accordance with his capabilities.

The planning of personnel and manpower development starts from the goals and future plans for the whole company, continues with the evaluation of the present personnel and ends with concrete plans for recruitment, training and promoting (Fig. 4).

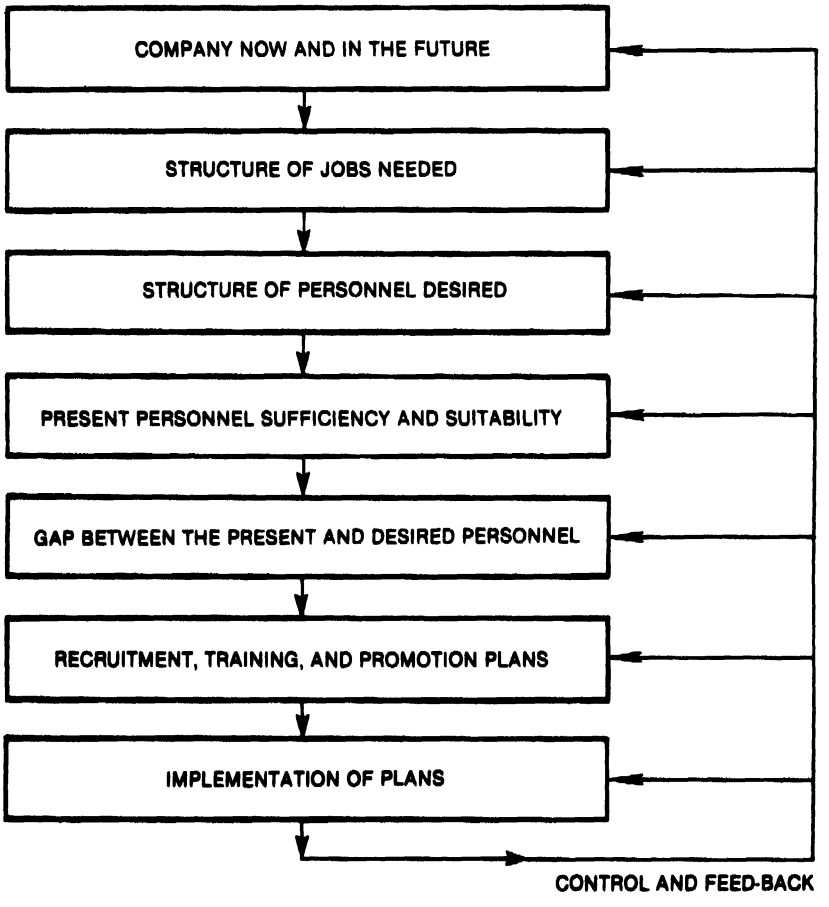


Fig. 4 PERSONNEL PLANNING AND MANPOWER DEVELOPMENT AS A PROCESS

2.2 Annual budget

The annual budget should include at least the following:

- present number of employees in different departments and jobs;
- number of trainees during the next year;
- number of additional personnel to be recruited.

All these estimates are dependent on the annual turnover of personnel. The turnover should be calculated after each year and kept at a reasonable level which is in the 10 to 20% range.

2.3 Personnel planning in a start-up situation

When a new mill is started up, personnel planning starts with the drawing of the organization chart and the listing of the manning plan. The budget takes into account the annual turnover which might be much bigger than in case of a mill already in operation.

A big personnel turnover during the first two years can be a result of the managers' critical evaluation of the work results compared with the defined targets for production. The totally absent orientation of newcomers and unsystematic on-the-job training at the work place are usually the main reasons why work efficiency is low and the worker himself unmotivated to work. As a result, many of the workers and even the supervisors leave the company.

When making the manning list and personnel budget the general manager often has to compromise between two factors which have influence in opposite directions. The first is the number and quality of worker positions needed in production and maintenance on the basis of the machinery, technical layout and stage of automation used in the mill. This factor usually requires less skilled workers. On the other hand, the situation and rate of unemployment in the country and especially in the mill community puts pressure on the manager to increase the number of employees and thus also increase the salary costs of the operation. The result of these two factors is often a compromise which decreases the profitability but increases the welfare role of the mill in society.

3. RECRUITMENT AND SELECTION

3.1 Analysis of the work and the worker

The first step in this process is to analyse each key position, to make the work descriptions and to define the different criteria for the workers.

This analysis should cover, at the worker level, at least the following:

- general function and area of responsibility, which means a broad-line definition of the position;
- first priority duties, which means a list of those areas for which the worker is in the first resort responsible, e.g. a production machine;
- secondary duties: for example cleaning or certain inspections;
- special tasks, e.g. fire-fighting or participation in a first-aid group;

- general qualifications, the level of education and work experience;

- special criteria of recruitment, e.g. physical condition or special training.

For the managerial level, this description is different and also includes the aspects of responsibility, relationship with other managers in the organization and reporting duties. The manager's description usually includes at least the following items:

- name
- position
- position and name of the superior to whom the main reporting is done
- position where the person could replace somebody
- position, the holder of which could replace the person concerned
- list of positions and names of subordinates
- main goal and area of job
- priority list of the main tasks
- responsibility and power
- time reserved for each main task
- cooperation and connections inside the organization or the department, and outside in the community.

Job description forms and models are often different in different organizations. They should have the same form for each manager in the same company.

Preparing job descriptions usually starts at highest level in the organization and continues until the supervisory or foreman level. Generally there is a discussion between the senior manager and his subordinate. The outline of the tasks and responsibilities of the job is discussed, after which the subordinate provides a draft in the accepted manner. His draft is discussed with the senior manager. In this final discussion his responsibilities and authority are laid down.

3.2 Criteria and selection procedure

Besides educational background and work experience, each position demands certain abilities and personal characteristics in the holder.

Depending on the position, the desired abilities are likely to be a combination of some of the following abilities:

- intelligence
- creativity/originality of ideas
- planning ability
- verbal ability/verbal comprehension
- logical thinking
- technical comprehension
- learning ability
- speed and accuracy of work
- numerical comprehension
- ability to organize
- spatial perception
- dexterity.

The desired personal characteristics are likely to include some of the following characteristics:

- authority
- mental stability
- ambition

- self-confidence
- tolerance of stress
- cooperativeness
- patience
- responsibility
- reliability
- independence
- dexterity.

To find out how well applicants meet the required criteria, some systematic methods may be used.

The following criteria are evaluated:

- basic education
- additional training
- work experience
- literacy and knowledge of language
- abilities
- personal characteristics and motivation
- health and physical condition
- age.

The selection criteria are evaluated on the basis of the following:

- written applications
- interviews
- psychological tests
- health examinations
- former job success rated by the previous superior.

Basic education, additional training, work experience, literacy and age can be ascertained via written applications and interviews. Health and physical condition can be medically checked. In order to find out about abilities, personal characteristics and motivation, psychological tests are used. Information given by former superiors, especially about previous work performances, complements all this.

Personnel should be selected by a group in which the personnel officer, industrial relations officer, the future superior and the psychological testing expert participate.

There are two different test series, one for management level, the other for worker level. The test for supervisory and foreman levels is a combination of these.

3.3 Recruitment plan

In a start-up project, the time schedules for recruiting different levels and key groups of personnel have to be carefully drawn up and coordinated with the training programmes and the project's time schedule as a whole. Recruitment should be early enough to allow enough time for training. On the other hand, it must be coordinated with the actual start-up and be late enough to avoid unnecessary salary costs. This is a dilemma which unfortunately usually leads to a situation where key personnel are either not trained or are frustrated by having to wait, and often leave the organization.

The recruitment plan should start with counting backward from the start-up date. It should give the time in months for each key group to be recruited and the name of the position to be filled. Rough estimates for the time interval in case of a new mill and at least partly inexperienced people are as follows:

- operational management 15 - 20 months

- supervisors and key operators
  . in production 6 - 9 months
  . in maintenance 9 - 12 months

- skilled workers 3 - 6 months

- semi-skilled workers, assistants and helpers 1 - 3 months

Estimates for renovation programmes in old mills where the personnel has comprehensive industrial experience are shorter. In this case, the question is more one of how to get the work force away from the present production and plants early enough and yet not lose the present production.

4. TRAINING IN MECHANICAL WOOD INDUSTRY

4.1 General

Training is development of knowledge, skills and aptitudes. Training in a certain industry is mainly vocational, i.e. it prepares people for a certain occupation.

Training in the mechanical wood industry has certain special characteristics. The industry is rather labour-intensive, the level of automation is low, and the technology and equipment are rather simple. Although the number of people to be trained is large, the skill required of most of them is modest.

On the other hand, having a number of subordinates means that the supervisor/manager must have a variety of skills and possess leadership, knowledge of motivation, and other managerial qualities.

4.2 Vocational training

Vocational training can be divided into two different phases, basic training and further training.

Basic training is understood to consist of all training in preparation for a certain vocation. University examinations as well as degrees from vocational institutes and schools come under this heading. Different kinds of vocational and employment courses are also statistically considered to be basic training, if their duration is at least four months. Basic vocational training includes vocational general knowledge and skills as well as basic training for specialized jobs.

Vocational further training includes all training after the basic. Supplementary training can be divided into the following, according to its purpose:

- orientation
- upgrading
- continuation
- retraining
- refresher training.

Orientation training trains a person in the tasks of a certain job and orientates him for the particular work conditions and surroundings.

Upgrading training keeps a person at the level of development that belongs to his tasks or vocation. The training can be closely related to the tasks of the job.

Continuation training prepares people who are already employed for a transfer to new, more demanding jobs by improving their skills and knowledge and usually also by increasing their formal competency.

Retraining prepares a person with certain vocational basic training for a transfer into a new job on the same level, or into a new vocation.

Refresher training is needed when there has been or will be, such big changes in the tasks of a job that the basic training acquired is no longer sufficient. Nor in this case is upgrading training appropriate.

4.3 Objectives of training

The long-term objectives of training in an organization are:

- from the employer's point of view, to ensure the constant availability of enough qualified personnel in all functions and on all levels;

- from the employee's point of view, to secure his livelihood and to upgrade him into a position in accordance with his personal aptitudes and resources.

The short-term objectives of training are:

- to increase the capability of personnel in their present positions;

- to increase motivation and job satisfaction;

- to improve occupational safety, operation and output of the production facilities.

In the startup of a new mill the objectives of training are as follows:

- to reach a satisfactory level of operations quickly;

- to increase the capacity of the personnel to the fullest extent by the time the startup process is over.

4.4 Training process

The best results in training can be reached if it is a planned process starting from the evaluation of needs and ending with the follow-up of results after each training action.

The process consists of the following main steps:

- evaluation of manpower requirements and training needs
- planning and programming
- execution
- follow-up.

4.4.1 Manpower requirements and training needs

Manpower requirements are dependent on the following:

- type and volume of production
- technology and equipment to be used

- level of automation
- number of shifts
- personnel turnover.

Estimates of the number of people needed is based on these factors.

The mechanical wood industry is very labour-intensive. The level of automation is low, technology and equipment are rather simple, but the number of workers is large.

Training needs are usually defined as the difference between the desired and the existing level of training. Identification of training needs usually involves answering the following four questions:

- why is training needed?
- who needs training?
- what kind of training is needed?
- how much training is needed?

Training needs depend on the different skill and knowledge requirements of each craft and occupation. The total workforce can be divided into different categories according to the skill required of them. The divisions in different mechanized wood industries are the following (source: FAO):

	Sawmills %	Plywood mills %	Particle-board mills %	Maintenance %
Technical and managerial	0.5	1.4	6.0	25.0
Skilled workers	15.4	21.2	27.0	38.0
Semi-skilled workers	24.5	19.8	18.0	6.0
Unskilled workers	59.6	57.6	49.0	31.0

The training needs for different posts are based on the job descriptions, in which the skill and other requirements of each job are analysed in terms of basic education, work experience, special skills and personal aptitudes.

The qualification requirements are checked against the resources of existing personnel or potential applicants and the training needs are defined in detail. This appraisal is carried out by using the following methods:

- ratings given by the superiors which include information on previous work performance, development potential and personal character;

- psychological tests which give information on aptitude, learning capacity and motivation;

- interviews by the training officer, which give additional information about desires and problems from the individual's point of view.

4.4.2 Planning and programming of training

There are different types of training and methods available, such as the following:

- public courses available in the country or abroad;
- special courses tailored for the company by the company itself or by an outside specialist;
- on-the-job training.

Combinations of different training methods have to be defined individually and for different groups. These should be included in the company's overall training plan.

4.4.3 Execution of training

This requires the support and participation of the whole management. Every company should have a training officer to coordinate and be in charge of training.

For external courses a training utilization plan should be drawn up in advance in order to ensure that full benefit is gained from the course.

In courses and seminars which are arranged internally, the managerial staff have to take an active role as teachers in their special fields.

Systematic on-the-job training requires job instructor training to be given to the most skilled foremen and workers, who in turn will train the workers.

4.4.4 Follow-up of training

Follow-up of training is the last but not the least phase in the training process. Most often it is partly or totally neglected. Follow-up should consist of the following elements:

- comparing the work performance with the set objectives;
- providing a base for utilization of the benefits of training;
- identifying further training needs.

Training should be continuously and systematically followed up. This should be based on action plans and written instructions created in connection with the training.

The criteria for follow-up could, for example, be increased productivity, improved quality, decreased accident rate, fewer machine breakdowns, job satisfaction, congenial atmosphere at the working place.

4.4.5 Time schedule for training

The correct scheduling of different training actions is important in startup projects where training has to be combined with the whole time schedule of engineering, construction, erection, trial runs and start of production. An example of this is shown in a flow chart presented in Fig. 5.

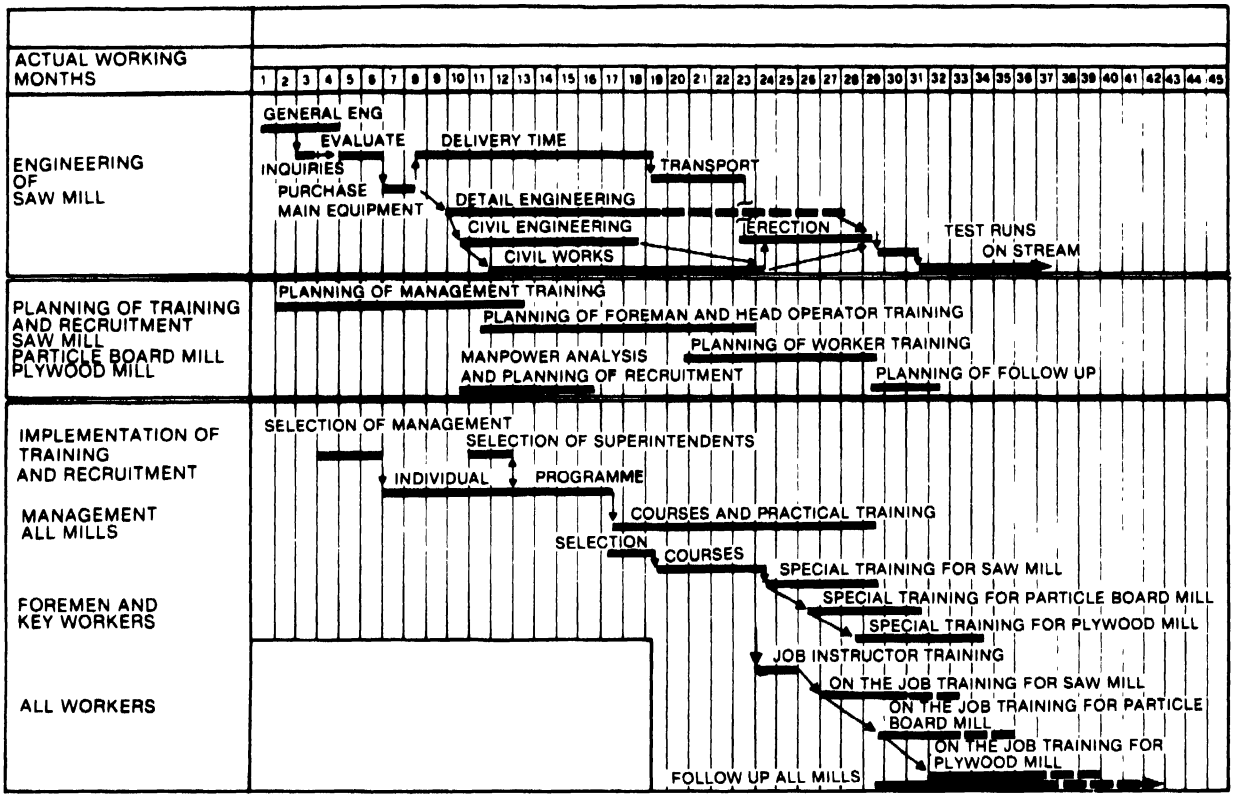


Fig. 5 FLOW CHART

4.5 Special questions in management training

Besides the technology of his special field, the manager has to master a wide range of management procedures and techniques.

In principle, managerial positions require a thorough basic education. This has usually been acquired in universities or technical colleges. Very often, especially in developing countries, the basic education is not directly related to the industry in question. The management training given by the company has therefore to focus partly on familiarization with the special technology and management procedures of the company and partly on keeping pace with the fast development of technology and business management in general.

In most cases training has to be "tailor made" in order to fulfil special needs. A combination of different methods has proved to be most suitable for management training.

4.5.1 Short courses and seminars tailored for the company

An in-plant management training programme includes all the management and supervisory personnel of the company and covers the common and special needs of the managers and supervisors.

The training is divided into four different courses:

- general management
- production management
- logging management
- maintenance management.

The duration of the courses is three to four weeks, divided between classroom training and practical application where the theoretical learning is applied. The management systems and policies are based on modern European and international systems modified for the local circumstances.

Courses are based on the individual company's own material as far as possible, and the teaching should be illustrated with practical examples and case studies.

All courses are tailor-made for each individual company. In order to make them so, some changes in the detailed course contents will possibly be necessary.

The programme of the general management course is as follows:

1. Management development
2. Company's industrial production
3. Organization
4. Planning
5. Use of manpower
6. Management decisions and delegation
7. Control
8. Marketing of products

The programme of the production management course includes the following:

1. The production processes
2. Production and sales planning
3. Production organization
4. Machinery and mill performance
5. Recovery
6. Storing and handling of raw material
7. Internal transportation
8. Side products and waste
9. Drying and storing of products
10. Blade maintenance
11. Production control
12. Cost control

The programme of the logging management course is as follows:

1. Wood as raw material
2. Felling technology and equipment
3. Measuring and bookkeeping
4. Skidding technology and equipment
6. Maintenance of logging tools and equipment
7. Road building and maintenance
8. Planning of logging operations
9. Use of management tools in logging
10. Logging organization and key personnel
11. Cost control

The programme maintenance management course is as follows:

1. Maintenance activities in general
2. Preventive maintenance
3. Planning of maintenance
4. Maintenance organization and key personnel
5. Registration of facilities
6. Failure and breakdown reporting
7. Machine and equipment inspections

8. Lubrication and services systems
9. Maintenance and repair of electrical equipment
10. Fault-finding systems
11. Budgeting for maintenance

4.5.2 Overseas training

Overseas training should always be tailored to the needs of the individuals or small group of trainees in question. The costs are usually so high that every effort should be made to get details of the programme to ensure that it is suitable for the trainees.

Management training abroad should include good orientation to the country, people and working methods. It should continue with theoretical course programmes mixed with systematic practical training in the industry. Individual study, tests and reporting are also important. An example of a six-month management training programme for general managers in mechanical wood industries is presented in Fig. 6.

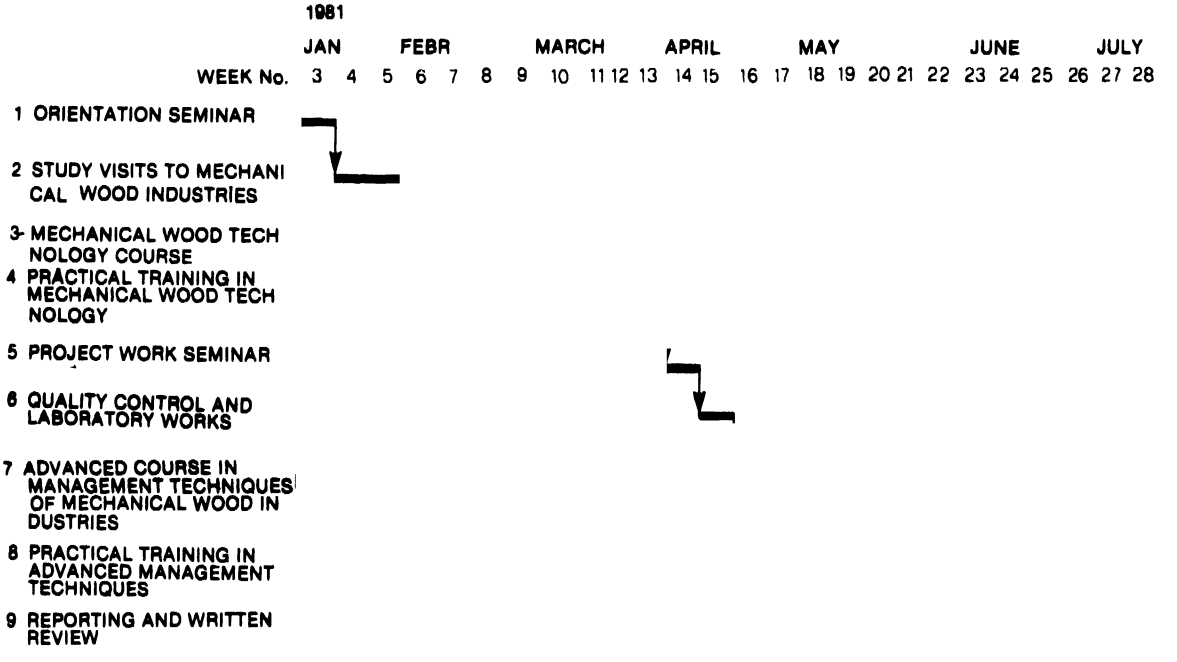


Fig. 6 MANAGEMENT TRAINING PROGRAMME

Vocational or process training abroad for key workers or supervisors is usually more difficult to organize. The programme should be run in only a few industrial places and the classroom programme should be well prepared beforehand, with good training material which has been translated into the language of the trainees.

4.5.3 Counterpart training

The level of managerial work and the performance of individual managers is highly dependent on the transfer of expertise and familiarity with everyday routines from the expatriate to the local managers. This will in fact happen through counterpart work, a logical way to put knowledge gained in the classroom into practice.

Counterpart work presumes double manning of the key managerial positions during the project stage. An expatriate specialist and a local manager hold the same position and work in close cooperation. Counterpart training includes management team work within the company, where local and expatriate managers can meet in different groups.

The aims of counterpart work are the following:

- to adapt management procedures to local conditions;
- to test the developed management procedures jointly (expatriate specialists and local managers);
- to ensure that the procedures developed are thoroughly mastered by the local managers by the end of the project.

The expertise which should be imparted is outlined in the manager's job description. The main tasks should be analysed and divided into parts, each of which can form a separate unit for teaching. The units should follow each other logically so that the training is effective and the importance of each unit and managerial task is in line with the whole project work and production.

The materials which form the basis for the managerial systems, e.g. report forms, flow sheets or economic calculations, are listed and used during training.

The training component in counterpart work should be combined and coordinated with the routine daily work. Separate training sessions and discussions are needed for only a limited time and the rest of the working time is used for "normal work".

4.6 Supervisory training

The supervisory staff is in an intermediate position between management and the workers. The skills and knowledge required of supervisors and foremen range from detailed technical skills to certain management procedures.

Supervisory level staff should preferably have a basic education from a technical college. As supplementary training they usually need training in leadership and management procedures. Sometimes courses in specialized technology are also needed, usually depending on their basic education.

The same training methods used for managers are suitable for supervisors. It must be remembered however that foremen and supervisors work on a practical level and therefore their training should have a strong application to this. The material should as far as possible be based on their own production and production statistics. Furthermore, the training should be strengthened by case studies and group work.

Special courses in operation planning and control should be arranged because these functions are in most cases badly neglected.

One good system for supervisors' training is to have them participate in and carry out worker-level training.

4.7 Workers' training

4.7.1 Classroom training for skilled workers

The main emphasis of classroom training is on skilled workers. They include machine operators, maintenance mechanics and electricians, vehicle drivers, sawdoctors and graders. Most of these workers should have some

kind of vocational basic education. In many cases, however, they lack basic education but have long and thorough practical experience.

Technical process training is aimed at: giving a thorough knowledge and mastery of the machines and equipment; introducing and improving the right working methods; implementing preventive maintenance; and increasing occupational safety.

4.7.2 Systematic on-the-job training for skilled and semi-skilled workers

Introduction and objectives of on-the-job training

A combination of specialized courses together with thorough in-plant training using the systematic on-the-job method is highly recommended for skilled workers.

Semi-skilled workers do not usually have any vocational basic education and they work in positions of assistants to the skilled workers or in positions which do not require special skills. On-the-job training provided by trained instructors is very suitable for semi-skilled workers.

Systematic on-the-job training is widely used in workers' training. As the title indicates, this is a systematic type of training mainly for manual work, in actual working conditions.

The training is usually carried out in two phases. In the first, the best workers and foremen of the company are trained to be job instructors. In the second phase these instructors train the workers.

The advantages of this training system are as follows:

- it enables a large number of workers to be trained at a relatively low cost;
- it creates a continuing system for the firm's training programme.

On-the-job training is given for the following reasons:

- the worker will have the knowledge he requires for his job;
- he can master the methods for correct performance;
- his attitude to the work is positive;
- he is willing to utilize all the knowledge and skills he has learned;
- he is able to perform his job correctly, quickly, without accidents and after a minimum training time;
- he is willing to cooperate with his fellow workers.

Preparations for training

Job training is given by qualified instructors who have been trained in advance from among the most skilled workers and foremen.

Each instructor usually has four to eight jobs to instruct on in his nearest working environment. He must have carefully prepared himself and the working place for instruction. The following preparations are essential:

- to draw up a training plan wherein it is stated in which order and when the workers will be instructed;

- to break the job down into methodological units and entities;

- to have the right equipment and materials at hand;

- to put the working place in order.

The four-step method in the training process

In actual training, the following method is used:

1st step

Prepare the workers for training:

- create a positive attitude between you and the trainees;
- explain the job;
- find out what they already know;
- encourage them to learn the job;
- place them correctly.

2nd step

Teach the job:

- explain, demonstrate, describe;
- teach each key phase which carries the work forward;
- emphasize key points of each phase;
- instruct clearly, calmly and accurately;
- do not teach too much at one time.

3rd step

Test the trainees' skills:

- put them to work;
- correct mistakes;
- let them do the job again;
- make sure that they understand;
- go on till you know that they can perform the job.

4th step

Check the results;

- tell the trainees who can instruct them again later if necessary;
- encourage them to ask questions;
- leave them working on their own;
- make frequent checks during the practice period;
- gradually shift over to ordinary observation.

Characteristics and application of systematic on-the-job training

The following characteristics are typical for systematic job training:

- the job is analysed in advance;
- the progress of training is planned in advance;
- the trainee is made to work correctly from the beginning;
- his progress is followed systematically.

The training method consists of explanations and demonstrations by the instructor along with the trainees' own endeavours and performances.

As a result of the systematic training process the instructor will obtain knowledge of his subordinates' working skills.

Job training is applicable in most cases of workers' training, such as the following:

- training new workers;
- improving the vocational skills of the personnel in their present jobs;
- training workers to use new machines;
- training workers for more demanding jobs;
- guiding short-term apprentices.

4.7.3 Orientation training

All employees should receive orientation training. Its aim is to familiarize them with the company and the working conditions, and to tell them of the rules and regulations concerning their employment. Orientation is especially important for newcomers and apprentices.

In start-up situations orientation is often in practice the only training given to the helpers and unskilled workers.

Helpers and unskilled workers work in positions which do not require any special skills. They must have general orientation to the working conditions and work environment as well as to the rules, regulations and safety aspects of their jobs. They must also be familiar with their individual duties.

Systematic on-the-job training is also applicable here but the training period is usually short and emphasis is on orientation.

5. MOTIVATION OF LABOUR FORCE

5.1 The concept of motivation

5.1.1 Motivation and work results

How an individual works depends on personal resources, good health, good motivation and sound methods. All these factors are related and the effects of motivation are especially important. A worker may have good skills and work methods, for instance, but he will not use them for the good of his organization without motivation.

Personal resources are a combination of personality, education and experience. Work methods depend on the systems and principles in the organization and on rules and instructions inside the work groups and rapport between managers and their subordinates. Poor tolerance of stress and unbalanced mental health can be even more dangerous than illness and weak physical condition, especially in managerial jobs.

Motivational factors can be roughly divided into work environment, human relations or social environment, and various incentives. These and other factors are shown in Fig. 7.

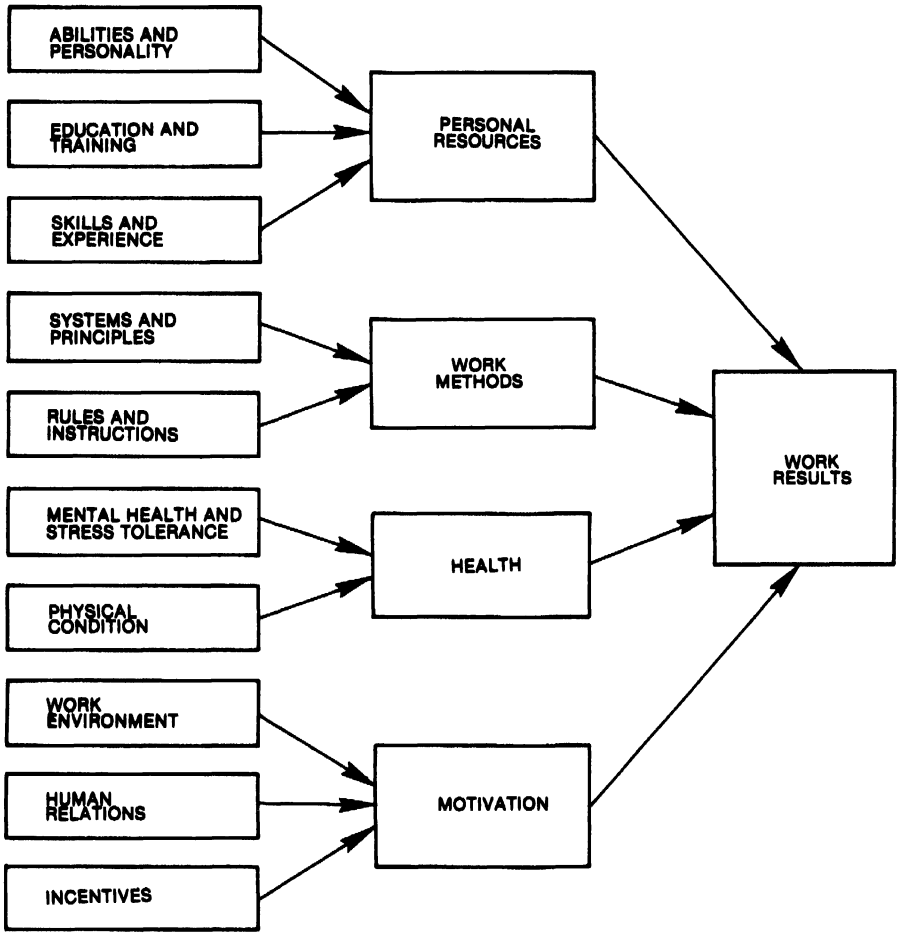
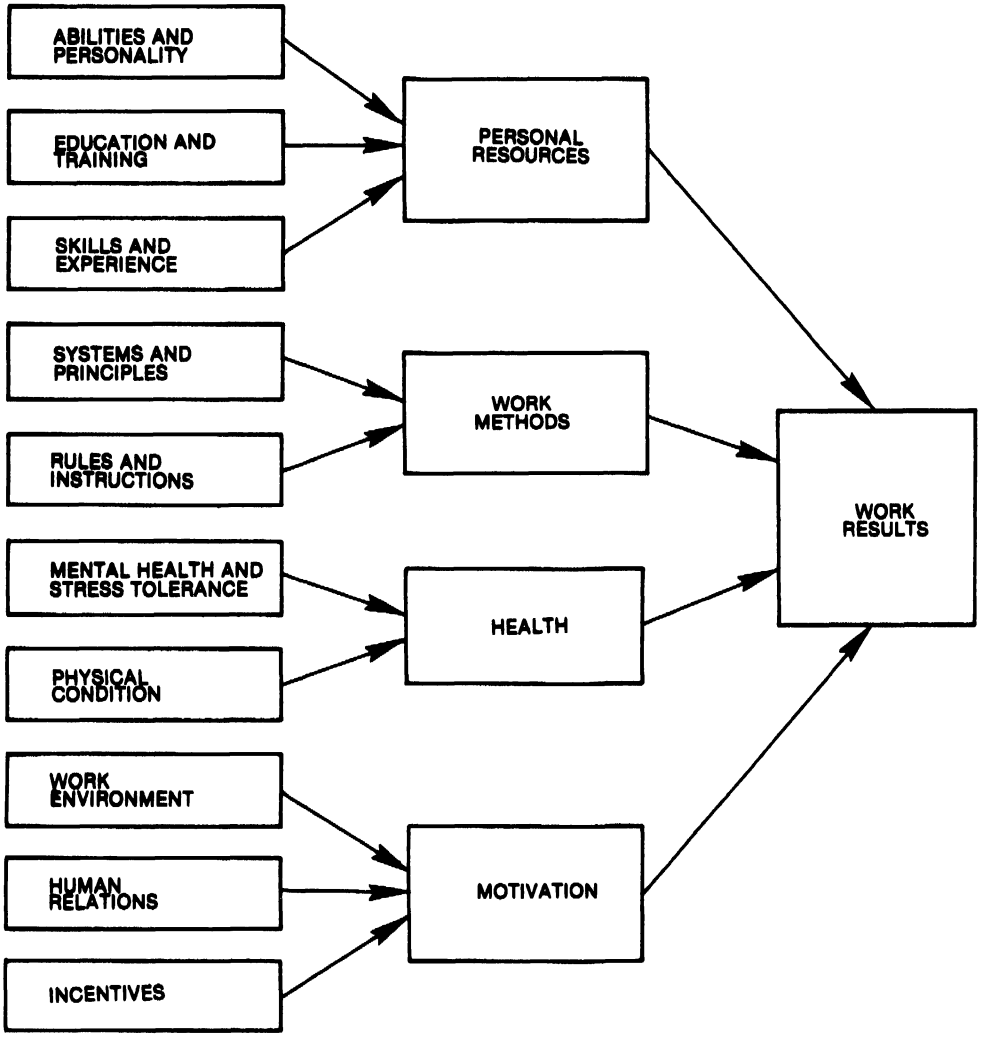


Fig. 7 FACTORS AFFECTING WORK RESULTS

5.1.2 Motivation and job satisfaction

Many studies on work motivation made in different societies and organizations indicate that motivation and job satisfaction are related to each other. Good motivation creates satisfaction and vice-versa.

This indicates that the same actions may be taken to create both satisfaction and motivation. There are, however, research results, which show that in some cases persons at the workplace can be well motivated and work hard without real satisfaction. Cases of the opposite also exist, where a person enjoys being at his work place but is not motivated and achieves no results. These situations are depicted in Fig. 8.



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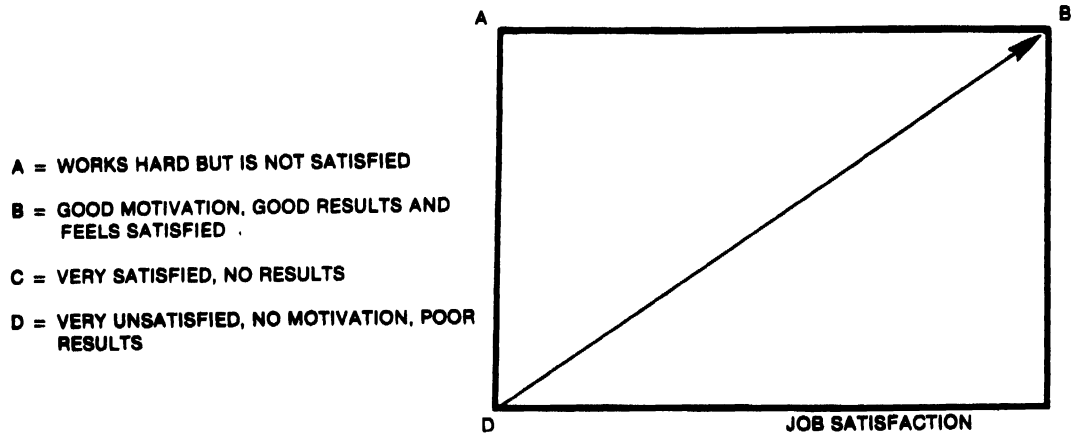

Fig. 8 MOTIVATION AND WORK RESULTS

5.1.3 Measurement of motivation

The climate in an organization can be measured in several ways. The most usual way is to measure the leadership styles which are affected by the skills and attitudes of the managers, and by the bureaucracy or democracy of the organization. The subordinates are usually asked to give their anonymous opinions in written questionnaires which can then be supplemented with oral interviews.

The second criterion, job satisfaction, is often measured only at the worker's level and administrative personnel level. The measurement is based on human needs, environmental factors, etc.

The third form of measurement is the evaluation of job results and success. This is done by the management and supervisors with merit rating methods. In industry the measurement of production, the quality and quantity of products and/or the time required to complete the work can be used. These methods are more objective.

The motivation of a labour force can also be measured by using the statistics of absence and personnel turnover. These statistics can also show differences between different departments or different managers.

5.2 Motivation and salary

5.2.1 Salary factors

One of the most discussed subjects is how to use salary as a motivating factor. It should be handled at least partly differently for workers and for managers.

The salary system in an organization is, in most cases, closely related to the formal policies of the whole industry or the whole country. Salary grades are usually used for worker positions, linked with training and grade tests. In rare supervisory positions and in a few managerial positions the amount of salary is also based on other factors.

The motivation and efficiency of the worker is strongly dependent on salary.

The salary system should be based on three factors:

- demands of the job
- targets and production results
- personal job success.

The role of these factors in the whole salary structure should be outlined as shown in Fig. 9.

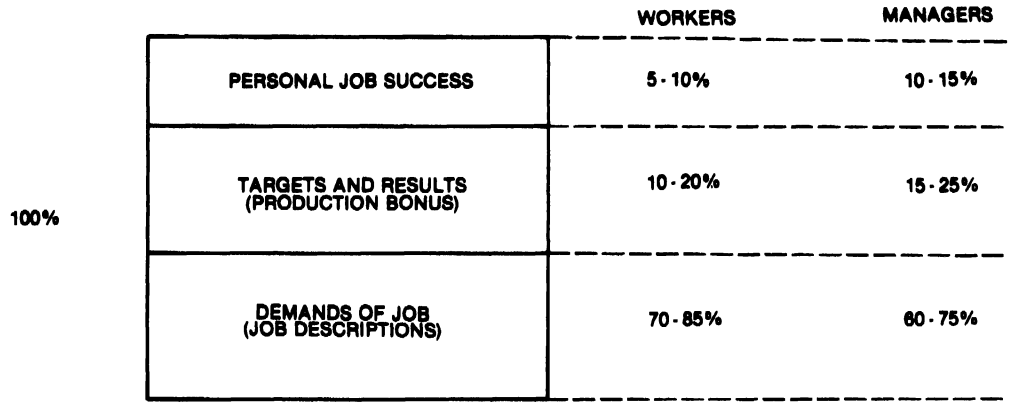

Fig. 9 SALARY FACTORS WITH THEIR RELATIVE IMPORTANCE

At the worker's level usually only the first factor is used. Practical examples exist, however, where a bonus system or personal benefits have also been used. For the management level the percentage range can be larger and, especially in private industry, all the salary factors are included.

At the worker's level, the demands of the job or the difficulty of the work are based on the following criteria or requirements:

- education
- experience
- qualifications
- responsibility
- work environment.

A joint scoring-committee usually defines and gives scores to some well-known worker positions, negotiates the salary for these and thus gets the basic salary curve for the organization. After completion of one scoring exercise all the other jobs are scored and placed on the same curve.

5.2.2 Bonus salary system

The possibility of paying an incentive in relation to the quality of the products should be used for the whole group or shift of workers.

The goals of a bonus system are as follows:

1. Clear connection between the value of work and the wage of each individual;

2. The bonus should be fair in relation to the workload, and motivate to higher productivity;

3. Individual wages should be in a fair ranking scale;

4. The system should be easy for individuals to check;

5. The average percentage limit for the amount of bonus, in relation to basic salaries or to annual production, should be agreed upon.

The motivating value of a bonus is dependent on the increase in percentages, on the level of basic salary and on the risk in salary costs which the organization is willing to take. Some examples and relationships of bonuses are shown in Figs. 10 to 12.

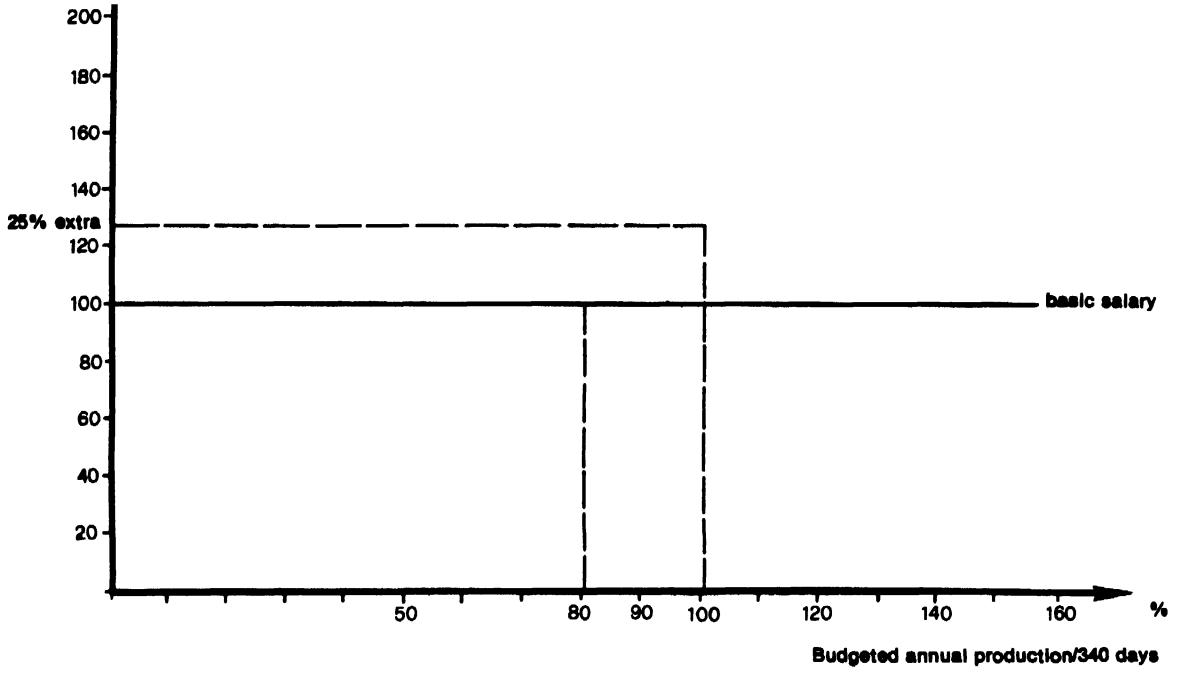

Fig. 10 BONUS AND PIECE SALARY SYSTEMS

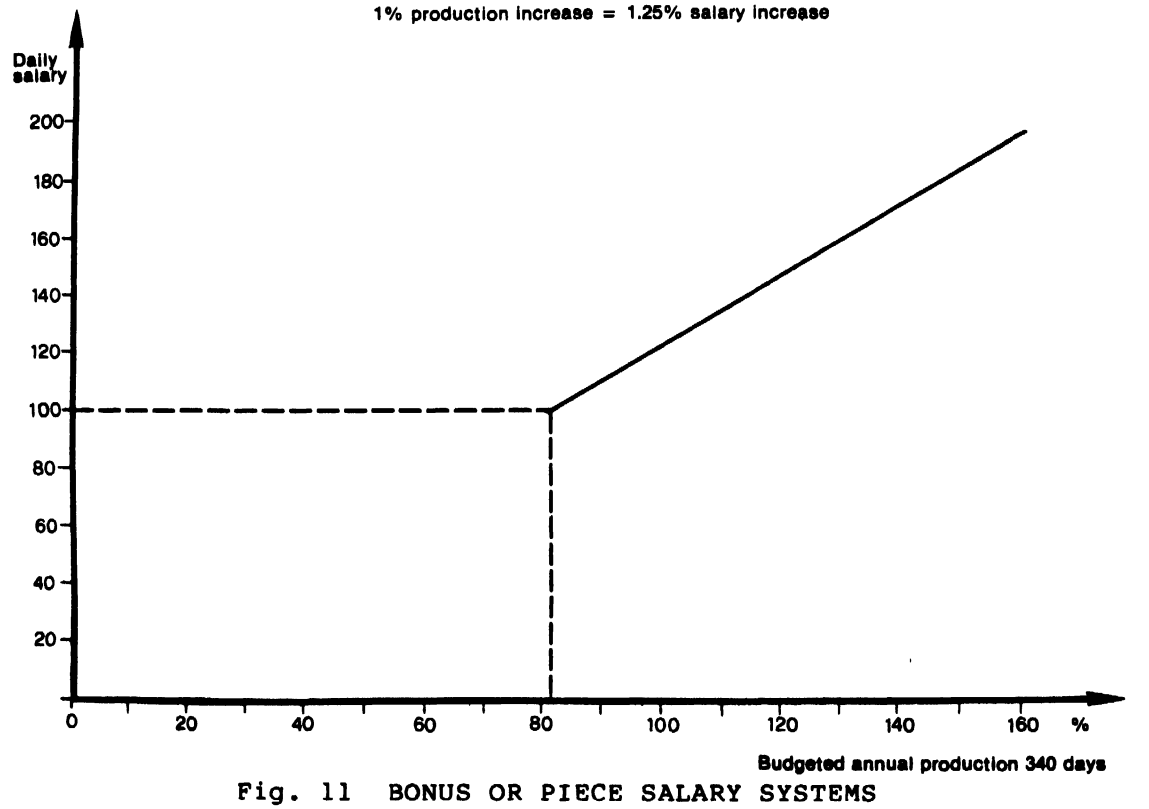

Fig. 11 BONUS OR PIECE SALARY SYSTEMS

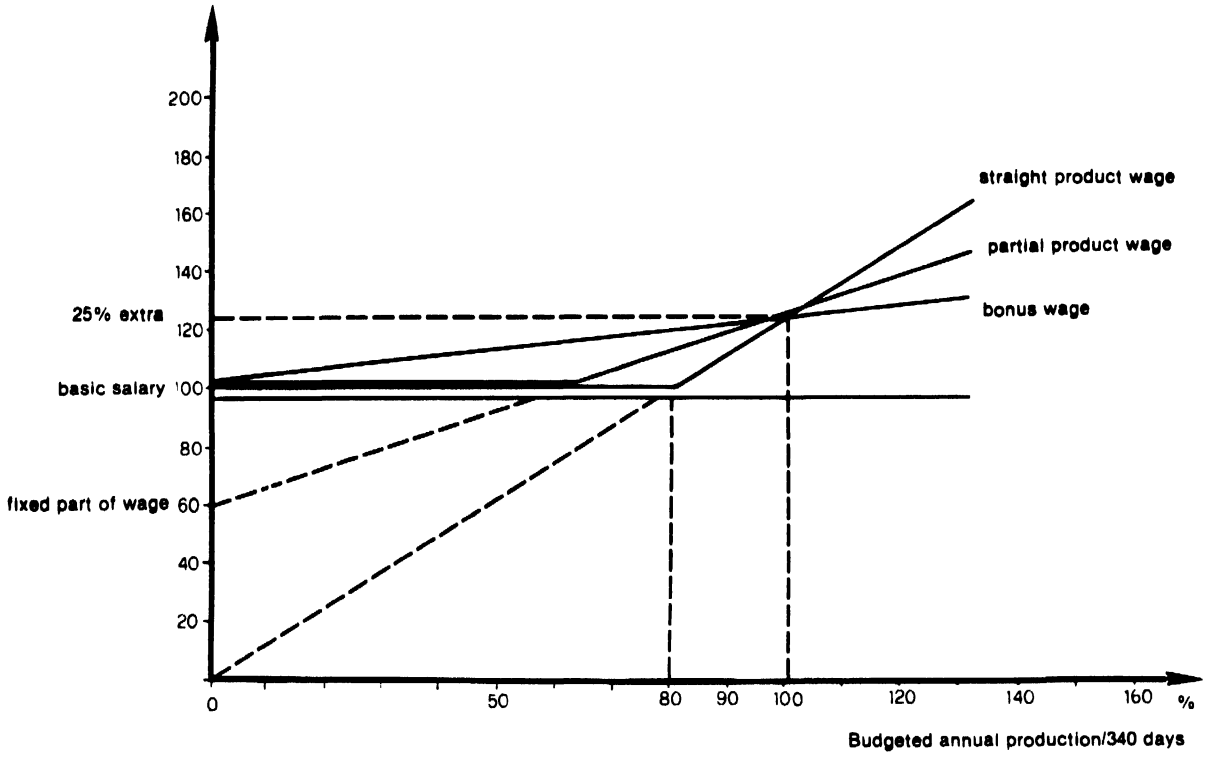

Fig. 12 BONUS OR PIECE SALARY SYSTEMS

5.2.3 Individual salary

Increase in an individual worker's salary should be based on the personal job success. Job results can be evaluated through merit rating. The supervisors or superintendents should rate their own workers in some characteristics which describe the level of work performance and the attitude toward work. Absence figures can be shown on the same form. The relationship between personal success and salary is shown in Fig. 13.

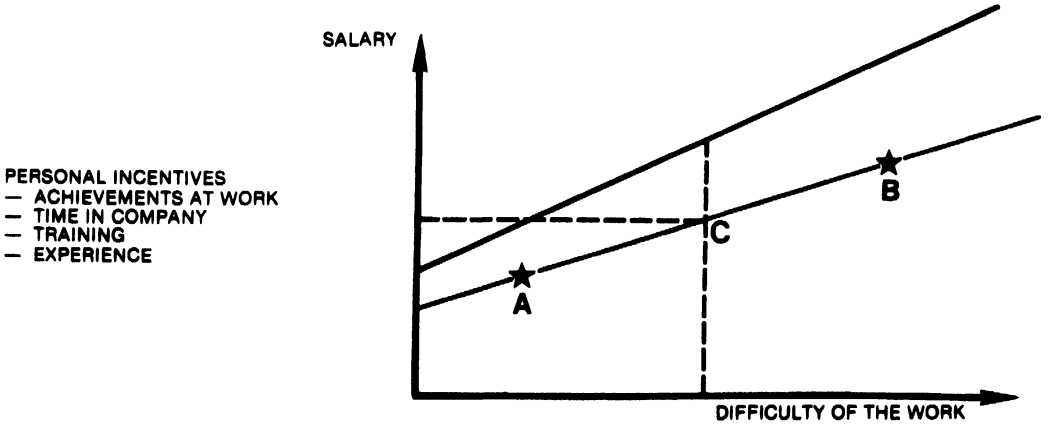

Fig. 13 SALARY IN RELATION TO THE DIFFICULTY OF THE WORK AND THE PERSON'S COMPETENCE

Managers often calculate their own salary and value in relation to other managers inside or outside their own organization. Studies have shown that this type of self-comparison is dependent on what level the person is at in the organization. Thus the general managers compare themselves with general managers of other companies, the next level of managers and the supervisors with each other inside the company, skilled key workers compare with workers outside the company.

5.3 Motivation through leadership

Leadership is necessary in all functions in which a manager manages his subordinates. As one aspect of personnel management, it can, however, be limited to the style or behaviour of the manager in dealing with his subordinates. This style of management is dependent on the rules of the organization and the personality and individual behaviour of the person himself.

The rules of an organization can be very strict and bureaucratic. If these are well known to the managers, they usually try to act in line with them. This brings a certain impersonality to the leadership. If rules do not exist or are only outlined, the manager is given more space to act in his own personal manner.

The personal style is measured with authority-democracy as shown in Fig. 14. An authoritative manager gives plenty of orders and less power for his subordinates to make their own decisions. A democratic manager gives more advice than orders and controls his subordinates through written reports or scheduled meetings.

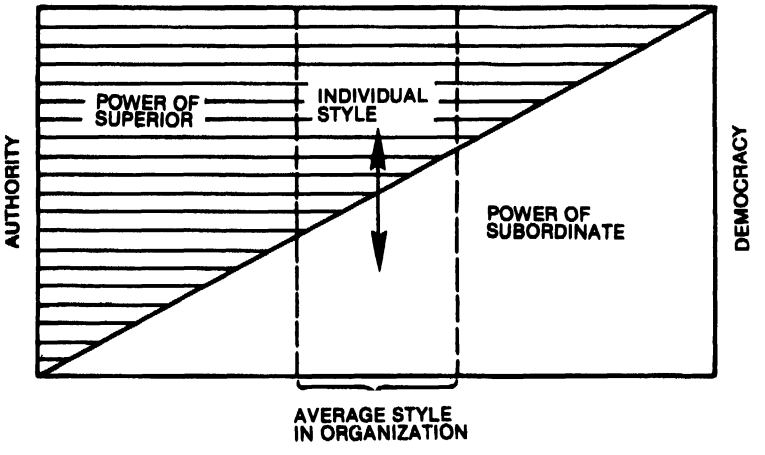

Fig. 14 MANAGERS' STYLE IN LEADERSHIP

The most difficult style is to lead in different situations. This means in practice that the manager has the ability to observe and analyse different managerial situations. If he can be flexible and change his personal style according to the task, people, time and other relevant factors, there are better possibilities of getting good results.

5.4 Motivation and participation

Information flow and participation can be combined in such a manner that influencing factors develop them both at the same time. Those factors usually differ in some respects especially at different levels of the organization.

A fast and effective way of participating, and getting information, for managers, is the system of meetings. When meetings are held in formal organizational groups, they also serve for reporting and the giving of orders. The "linking persons" are in key positions and can either create or stop the information flow. An illustration of linkages is shown in Fig. 15.

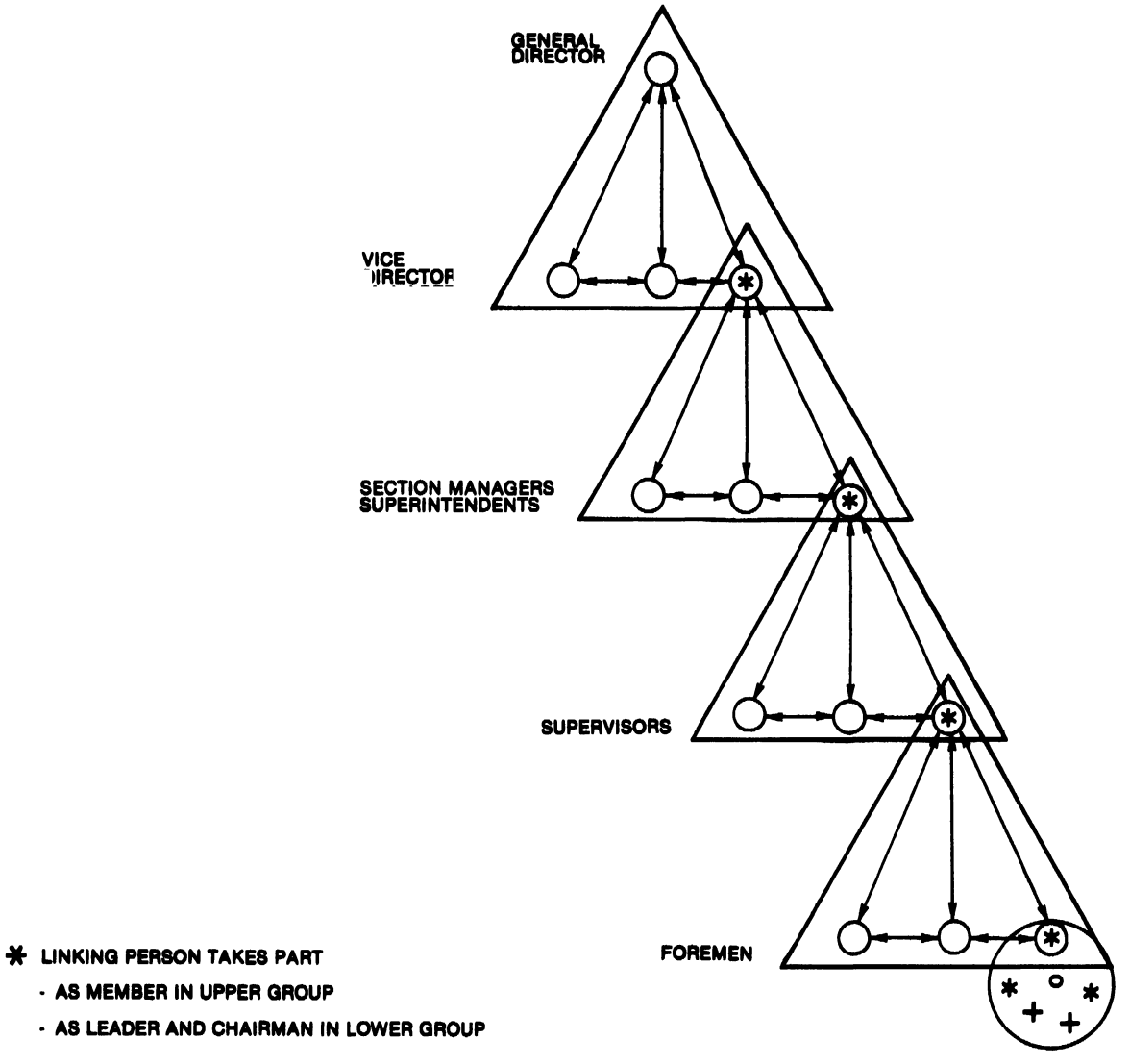

Fig. 15 MEETING GROUPS IN HIERARCHICAL ORGANIZATION

5.5 Motivation of workers

An analysis of motivation reveals that human beings behave at work, as well as at home, according to basic needs which they try to satisfy.

The first need is food and sleep, which cannot be met by anything else. So a satisfactory level of meals, housing and sleeping after work must be organized.

The second need is safety, which means not only safety against accidents and care of health but also the security of a permanent job, a fixed salary and a stable standard of living.

The third need is social belonging, which means acceptance in some group of people. This group can be one's own family, good neighbours or a work group. Social contacts are necessary for most of us.

The means to create motivation are thus the following:

- good salary
- safe work conditions, permanent job
- work in group and personal value in production.

In practice the management should create and consider the following:

- more salary (connected to production)
- supervising through the groups
- identifying the worker with his own group (clothes, other symbols)
- participating through systematic information
- punishment with fair rules (if discipline is weak)
- better skill and better satisfaction through training and orientation to the whole production process.

5.6 Summary of factors motivating managers and supervisors

A Create individual development programmes which are discussed between the senior manager and his subordinate and which will lead to better jobs or higher positions.

B Organize group work, not only inside the line organization but also between various experts in connection with development plans.

C Use leadership styles where the division of tasks and responsibilities is connected with warm interpersonal relations. Remember that each individual is different and does not always behave in the same way as others.

D Define tasks and objectives for small groups and individuals with them. Put on paper the control system for each key task and main objective.

E Remember to be fair and not parsimonious when improving environmental conditions. The costs can be low compared with the positive change in satisfaction and motivation.

F Try to use fair salary systems which are based on an analysis of work and job descriptions. In addition, try to use individual accession based on good performance.

The list of motivational factors in Scandinavia includes:

- responsibility
- achievements
- the work itself
- recognition.

METHODS AND TECHNIQUES IN PROFITABILITY ANALYSES

by

Jyrki Setälä
Jaakko Pöyry Oy

1. GENERAL

What is profitability?

Generally speaking, profitability is the rate of profit obtained or generated in a project. But when analysing different projects, one notices that there is no unique measure for determining the value of benefits in the sense that only one standard index could be used to rank all possible projects.

It often depends on the attitude of the estimator whether profit is to be calculated from the viewpoint of the individual, the company, the public sector, the whole country or even more widely internationally.

Resources are controlled by many different entities from individuals to government agencies, and each allocates investments to projects which give the highest return. But the scope of the measuring system can be quite different depending on the viewpoint from which the "highest" return is seen.

The term "commercial profitability" is used here in the sense of monetary profits, determining the relationship between outflow and inflow of funds for goods and services. The analysis is made from the viewpoint of specific entities involved in the project, normally private ones.

The term "economic profitability" is simply an extension of the above concept, in which the specific entity now becomes society as an undifferentiated whole. The limited resources of a nation are to be allocated to where they make the greatest contribution.

Economically attractive projects may not attract private investors if the commercial profitability is not satisfactory. In that case, the government or the public sector can provide incentives and subsidies.

On the other hand, a project can appear more attractive commercially than economically, and this can induce the government to impose a tax on that activity (examples are the manufacture of alcoholic drinks, casinos, exploration for crude oil).

2. SUMMARY TABLE OF METHODS

The family of profitability calculation methods and techniques is shown in Fig. 1.

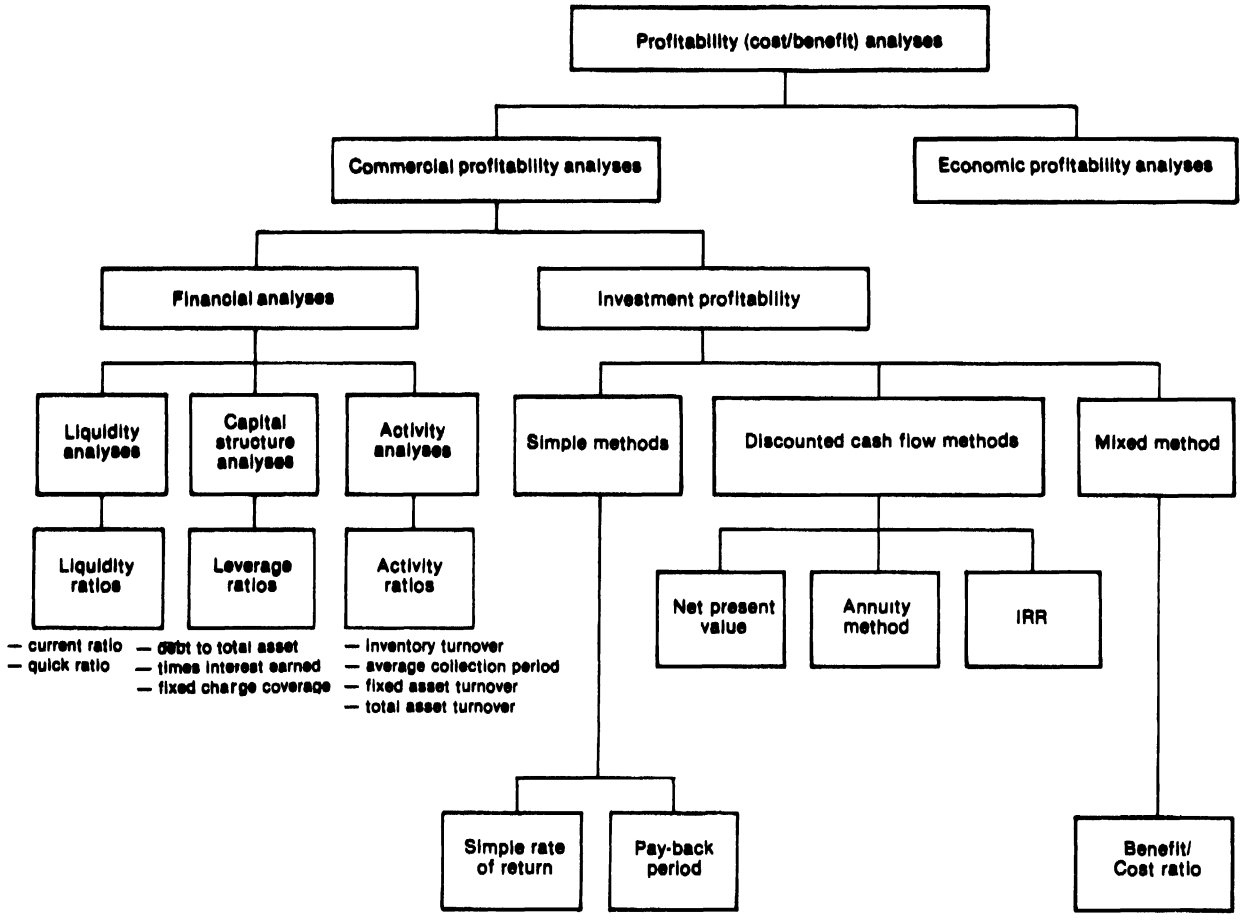

Fig. 1 FAMILY OF PROFITABILITY CALCULATIONS

In commercial analysis particularly there is a problem to solve. What is the method to be chosen for determining profitability?

To run a commercial venture involves the following:

- being able to repay loans and interest;
- being able to make the required profit after depreciation;
- being able to earn the required return on the shareholders' equity and/or
- generating capital for future applications.

Examining the results of your methods and measures for running your company will show how successful you have been in reaching the objectives.

Analysing methods for new investment plans simulates, in simplified form, the impact of new plans on the economy of the company.

Where investment plans are concerned and the investments are large, similar methods to those used for running companies can sometimes be applied with additional calculations.

Choosing the right method for investment plans is sometimes difficult. Factors affecting the choice are the following:

- reliability and accuracy of basic information
- targets of study
- company practices
- the object being studied.

There is no use in making detailed, far-reaching and scientific calculations if the basic information is not accurate enough. Choose the method where workload, working resources and the results of the work are in balance.

3. ELEMENTS OF INPUT

3.1 Capital items

The basic structure is as follows:

Plant investment

- direct cost
  (buildings and constructions, site works, machinery and equipment, freight, installation)

- indirect costs
  (temporary facilities and services, engineering and construction supervision, project administration, fees, duties and taxes, insurances).

- contingency.

Preoperational expenses

- salaries and wages during construction
- training, recruiting
- start-up expenses
- legal expenses
- studies and general services
- company overheads
- production losses in the construction period due to the investment.

Financing charges

- interest during construction period
- bank fees and charges
- guarantee fees.

Working capital

- inventories

  . raw materials
  . materials in process
  . finished products in store
  . spare parts and supplies in store

- advanced payments
- accounts receivable
- accounts payable
- cash.

Cost of land

Off-site facilities

- ports and loading places
- technical connections.

Infrastructure

- housing
- public connections.

Capital items during production period

- replacements
- increase of initial working capital.

Forestry operations are important for a wood based industry. If a company is new and forestry operations are to be established simultaneously with the industry, then forestry is a separate investment object. Forestry operations are treated basically in the same way as industry in the following circumstances:

- where the share of salaries, wages and operating costs in the initial, preoperating phase is, in general, large;

- where replacement time of most investments is short;

- when the number of variations from case to case is large.

3.2 Depreciation

Things wear out. This wearing out could be physical or an obsolescence due to several reasons.

Depreciation is an input value. Its use and interpretation are wide:

1. Tax allowance: This is understood as a book transaction used to reduce the annual tax amount payable. It does not involve any cash expenditure;

2. Cost of operation: This is sometimes included in manufacturing costs as labour or raw material. Care is needed here as some profitability calculations may include depreciation twice;

3. Means of building up a fund to finance plant replacement;

4. Measure of falling value.

The most frequent methods used to calculate depreciation are as follows:

1. Straight-line method

$$\text{Annual depreciation (AD)} = \frac{\text{investment (I) - salvage value}}{\text{number of years (NY)}}$$

Book value (BV) in the end of year N (BV_N) = $I - NY \times AD$

2. Declining balance (or fixed percentage) method

AD = r percent of remaining book value, BV_N

$BV_N = I(1 - r)^N$

Other methods exist but their practical importance is small. See Fig. 2 for the behaviour pattern of different methods.

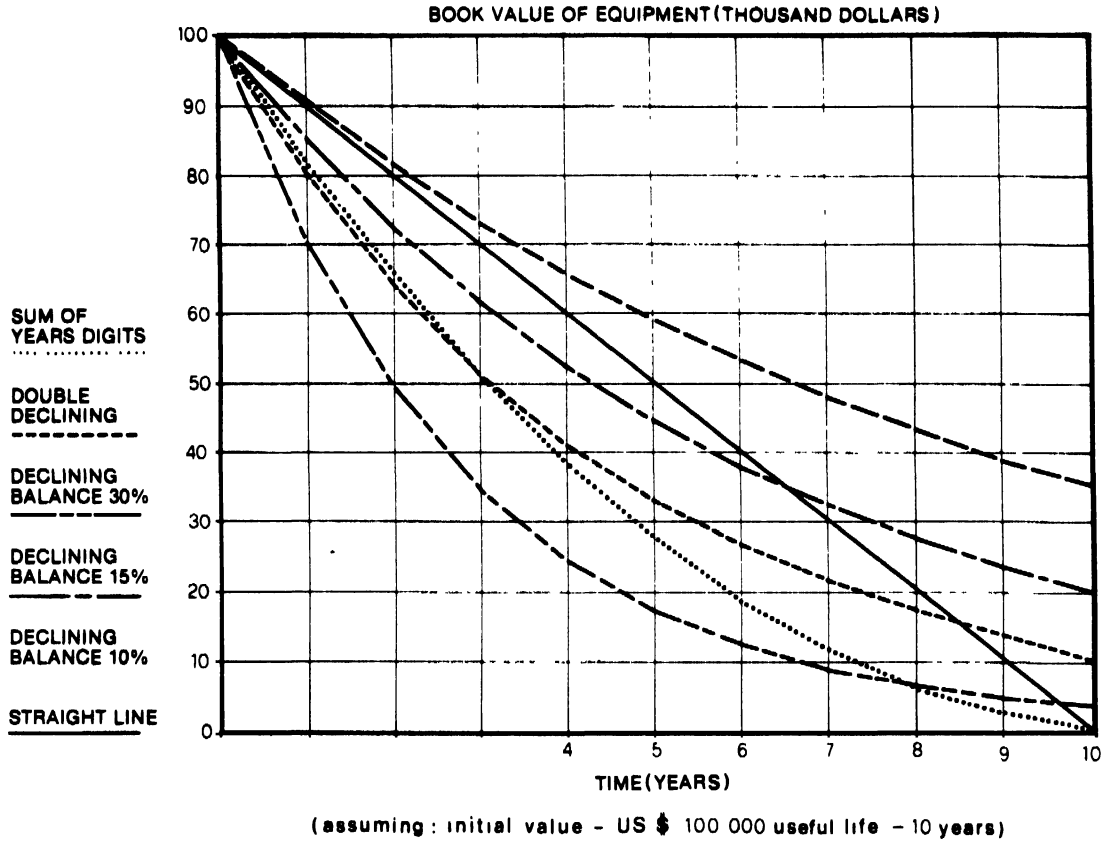

Fig. 2 DEPRECIATION METHODS

3.3 Production or operation cost

Grouping of some costs and expenses[1/]

	Variable	Fixed
Manufacturing expenses		
- direct	raw materials, chemicals, energy, utilities, packing, operating supplies	operating labour and supervision costs, fixed energy charges
- indirect	maintenance supplies, storage facilities, control laboratory	maintenance labour cost

1/ Note that not included here are interest, sales expenses, taxes and depreciation, which are handled separately.

General expenses

- direct	research and development	administrative labour costs, advertising, marketing, patents
- indirect	outside services	representation, public relations, rents

Note: Almost any item can be transferred and/or subdivided into another group, depending on interpretation and needs.

4. METHODS OF CALCULATING PROFITABILITY

4.1 Simple methods

4.1.1 Simple rate of return

The basic model is as follows:

ROI = Return on investment

A term ROI is used on so many occasions and in so many connections that is not always clear what the calculation method in question is. In this paper it means the following:

$$\text{Simplified rate of return (i)} = \frac{\text{Annual result}}{\text{Capital}}$$

Annual result is most often understood in Europe to be the operating margin. In the USA the tax element is considered. The economist usually takes depreciations and tax elements into consideration.

Later in this section will be found an example of an income statement.

From this example the following annual results may be taken to use in profitability calculations:

		Value
(7)	Operating margin, annual gross profit	30
(12)	Cash income	25
(14)	Taxable income	15
(16)	Net profit	12
(17)	Net cash income	22

All are different.

Capital values can also be different. They may be as follows:

(a) Initial investment;

(b) Remaining value of capital after depreciation in a given year and capital employed;

(c) Average capital value over the useful lifetime of the project;

(d) Current capital where fixed investments are valued according to their replacement value.

The relative size of the different elements are

$a > b,\ a > c,\ a \gtrsim d$

When the different profits and different capitals are inserted in the simplified ROI formula, a series of numbers is created.

The following formulas are recommended:

Alternative 1

Project profitability calculations

$$i = \frac{\text{operating margin (-taxes)}}{\text{initial investment}} \times 100$$

Alternative 2

Project profitability calculations

$$i = \frac{\text{operating margin - depreciations (-taxes)}}{\text{initial investment}} \times 100$$

Alternative 3

Running companies

$$i = \frac{\text{operating margin - depreciations - taxes}}{\text{capital employed}} \times 100$$

Alternative 4

Running companies

$$i = \frac{\text{operating margin - depreciations - taxes}}{\text{current value of capital}} \times 100$$

The number of profitable vendors needed will be presented later.

INCOME STATEMENT

Example for ROI calculations, 7th year of operation

Capital values

Fixed investment	100
Working capital	10
TOTAL INITIAL CAPITAL VALUE	110

Income statement

1	Gross sales	55
2	Sales adjustments	5
3	Turnover (net sales)	50
4	Variable costs	13
5	Contribution margin	37
6	Fixed costs	7
7	Operating margin or gross profit	30

10	Interest on loans (interest actually paid)	
12	Cash income	25
13	Depreciation (straight line, 10 years)	10
14	Taxable income	15
15	Income tax	3
16	Net profit	12
	Add depreciations	10
17	Net cash income	22

4.1.2 Pay-back period

This method measures the time needed (calculated from start-up of production in new projects) to pay off the initial investment.

The pay-back period can be calculated with or without interest.

Without interest the result, in years, is the invested value of alternative 1 formula in section 4.1.1.

$$\text{time (a)} = \frac{\text{initial investment}}{\text{operating margin}}$$

The interest rate may be added in the calculations. If the pay-back period is short, a moderate interest rate has no practical effect on the results and in that case can be omitted.

4.2 Discounted cash flow methods

4.2.1 General

The most common of these methods, which are based on time value of money, is the annuity method. By developing calculations, the net present value and the internal rate of return have also been commonly used. These methods take the following into consideration:

- time value of money
  The sooner the return occurs, the better.

- economic lifetime
  The economic lifetime of the project must be established.

- salvage value
  Salvage value or payments after the economic lifetime can be included without overvaluing their weight in the result.

- interest rate
  The interest rate applied to or resulting from the calculations correlates closely with the real value of money (alternative investments, cost of borrowed capital).

4.2.2 Compound interest

The methods are not based on the following simple interest rate formula:

Future value = present value x (1 + No. of periods + i)

where i is the period's interest rate expressed e.g. 10% equals i = 0.10.

The formula applied is for annual compound interest:

Future value = present value x $(1 + i)^{\text{No. of periods}}$

Example

From newspapers in the spring of 1984 we read that the Israeli inflation rate was approximately 20.1% per month. The formula for simple interest gives an annual rate of 12 x 20.1% or 241.2% p.a. The formula for annual compound interest gives a considerably higher rate $(1 + 0.201)^{12} = 9.01$ or 901% p.a. The first formula can be applied only when the periodic rate is small and the number of periods is small.

4.2.3 Economic lifetime

Economic lifetime is the time in which the initial investment must be recovered. Economic lifetime is of a highly subjective nature and can be affected in many ways:

- The economic lifetime of an investment cannot be longer than the physical lifetime of main equipment;
- It cannot extend beyond the time when the high replacement investments of a factory start or productivity decreases;
- It may be the lifetime of the product(s) to be produced;
- The time in which most of the debts must be amortized;
- The time in which own capital must be recovered;
- The time in which artifical benefits could disappear (e.g. benefits of political origin, subsidies);
- The time in which the production technology becomes obsolete or the project otherwise loses its cost on competitiveness;
- It also depends on the national economic viewpoint or commercial viewpoint.

Some examples of economic lifetime in commercial projects are presented in Table 1.

Table 1

RECOMMENDATIONS FOR ECONOMIC LIFETIME OF COMMERCIAL WOOD INDUSTRY PROJECTS

Project	Economic lifetime (years)
Large-scale pulp mills*	15-20
Large-scale paper mills*	10-15
Small-scale paper mills*	8-12
Large-scale wood panel mills*	8-12
Small-scale wood panel mills*	6-10
Large-scale sawmills*	8-12
Small-scale sawmills	4-8
Various machinery	4-8
Converted products	4-8

*) Technical design and cost calculations should be carried out according to the data given above, provided the physical operation of the mill is not considerably longer.

4.2.4 Annuity method

The annuity method is intermediate between simple and cash flow methods. In the annuity method, profitability is calculated according to the following formula:

```
+ Income
- Cost of production
= Operating margin

- Annual capital charge incl. interest and amortization
= Result
  ======
```

Operating margin is calculated for a typical year and the initial investment is converted into an annual capital charge. The formula is as follows:

$$\text{Annual capital charge} = \frac{i}{1-(1+i)^{-n}}$$

where

- i = interest rate per period (e.g. .10)
- n = number of periods (economic lifetime)

The factors are usually obtained from tables. This method is widespread in comparison with the alternatives.

4.2.5 Net present value

The net present value method accepts annual cash payments or earnings of different size. In the beginning the payment(s) could be negative due to the initial investment. Later on the project earns money. The general formula is as follows:

	Construction period	Operation period
Annual earnings	-	+ Income
Annual earnings	-	- Cost of production
Annual earnings	-	= Operating margin
Investment without any financing charges	- Investment payment cash	- Investment payment cash
Result	= cash flow	= cash flow
Length	Depending on project	Economic lifetime

An additional factor to be given is the interest rate to be applied. The discounted net present value for each year is calculated and these are added together. Calculation is easy with a pocket calculator but tables can also be used. A numerical example is given later.

The result could be negative, zero or positive. If the accumulated net present value (NPV) is positive the project earns money.

4.2.6 Internal rate of return

The internal rate of return (IRR), or discounted cash flow rate, is used as a tool for the ranking of different investments. It is similar to

the NPV method, but it puts the question: "What is the interest rate of a cash flow which gives zero net present value?"

IRR is the effective interest obtainable on an investment when the investment is earned back in the given lifetime of the project.

Two kinds of IRR exist:

- on the total investment
- on equity capital.

In the first case the IRR is calculated for a cash flow as was shown in the NPV method. In the second case, only equity capital paid is understood to be investment, all the other cost elements being converted into annual cost. With foreign debts, the financed portion of investment is converted into annual interest payment and loan amortizations, and deducted from cash flow.

Corporate taxes can be included or excluded in the calculations. This should be mentioned in connection with IRR reports by specifying, before or after taxes.

4.3 Mixed method

Benefit/cost ratio

There are three main forms:

- discounted gross benefits divided by the sum of discounted investment and operating costs (total costs);
- discounted gross benefits minus operating costs divided by discounted investment costs;
- the sum of discounted net benefits in those years when gross benefits exceed total costs, divided by the sum of discounted net costs in those years when total costs exceed gross benefits.

The benefit/cost ratio, at the discount rate assumed, means the project generates benefits at 'x' times the value of resources used (both expressed in present value terms).

This method is not widely used in European commerce.

5. NUMERICAL EXAMPLE OF PROJECT PROFITABILITY CALCULATIONS

5.1 Basic data

In Table 2 a summary is presented of a new mill's annual revenues and cost calculations in the form of a cash flow statement.

Note the following features:

- production build-up curve
- market penetration costs
- higher unit costs when mill is new and operating at reduced capacity
- investment payment according to cash payment terms (S-shape)
- gradually increasing replacements
- initial working capital for inventories
- increasing working capital due to increasing sales
- salvage value is a theoretical one.

Table 2

CASH FLOW STATEMENT

Year	Construction Period -3	-2	-1	Operation Period 1	2	3...14	15	Salvage value
Production, units/a	-	-	-	60	80	10	100	-
Unit sales price	-	-	-	90	100	100	100	-
Sales revenue	-	-	-	5 400	8 000	10 000	10 000	-
Variable costs								
- unit cost	-	-	-	60	52	50	50	-
- annual cost	-	-	-	3 600	4 160	5 000	5 000	-
Fixed cost	-	-	-	1 000	1 000	900	1 100	-
TOTAL COST	-	-	-	4 600	5 160	5 900	6 100	-
Operating margin	-	-	-	800	2 840	4 100	3 900	-
Taxes paid	-	-	-	-	-	150	500	-
Operating margin after taxes	-	-	-	800	2 840	3 950	3 400	-
Investments								
- initial investments	3 500	4 100	4 000	500	-	-	-	-1 000
- replacements	-	-	-	-	100	400	-	-
- working capital increase	-	-	1 000	1 000	600	-	-	-2 500
TOTAL INVESTMENT	3 500	4 100	5 000	1 500	600	400	-	-3 500
Cash Flow	-3 500	-4 100	-5 000	-700	2 440	3 550	3 400	3 500

In Table 3 the same figures are presented for a typical year only. Investments are increased by interest during the construction period and thus transferred to the start up of the production. No attention was given to the start up years.

Table 3

SIMPLIFIED CASH FLOW

	Investments	Earnings (typical year)
Production, units/a	-	100
Unit sales price	-	100
Sales revenue	-	10 000
Variable costs		
- unit cost	-	50
- annual cost	-	5 000
Fixed cost	-	900
Total cost	-	5 900
Operating margin	-	4 100
Taxes	-	150
Operating margin after taxes	-	3 950
Annual replacements	-	400
Net for capital		3 550
Initial investments	12 100	
Interest during construction period	1 780	
Fixed investments	13 880	
Working capital at full capacity	2 500	
TOTAL CAPITAL	16 380	

5.2 Profitability indicators

In Table 4 some profitability indicators of the figures from the previous two tables are presented.

Because of the time value of money the indicators based on "real" cash flow are slightly worse.

The indicators giving percentage value or payback time are simple, but offer a clear picture of the profitability. The other methods do not.

In this connection it should be remembered that engineer's ROI, the annuity factor and the IRR are all the same group of indicators for a cash flow like that shown in Table 3.

Internal rate of return (lifetime of 15 years)	20.3%

Annuity factor - interest rate 20.3% p.a. - 15 years	21.7%
Engineer's ROI	21.7%

The internal connection between the NPV and the IRR can be seen from results of both cash flows. The NPV of total cash flow is zero, according to the definition of IRR, when the discounting factor is equal to IRR.

In the forest industry or in other capital intensive industries the following ranking for the numerical value of profitability indicators could be applied:

	Satisfactory results
Engineer's ROI	> 20%
Economist's ROI	> 14%
Payback period	< 5 years
IRR on total investment before taxes	> 17%
IRR on total investment after taxes	> 15%
IRR on total equity after taxes	> 22%
Operating margin of turnover	> 28%

Table 4

SOME PROJECT PROFITABILITY INDICATORS

	Reference	Cash flow	Simplified cash flow	Remarks
		Table 2	Table 3	
Engineer's ROI	Section 4.1.1	..	21.7 %	
Economist's ROI	Section 4.1.1	..	16.0 %	15 a
Payback period	Section 4.1.2	5.1 a	4.6 a	0 %
Payback period		7.9 a	6.5 a	10 %
Annuity method				10 %, 15 a
- profit	Section 4.2.4	..	1475/a	0.1315
	Section 4.2.4			
- profit	Section 4.2.4	..	802/a	15 %, 15 a
				0.1710
Net present value	Section 4.2.5	38 440	36 870	0 %
		7 468	10 622	10 %
		1 576	4 378	15 %
		-1 829	218	20 %
		-3 865	-2 680	25 %
INTERNAL RATE OF RETURN		17.0 %	20.3 %	

5.3 Return on equity

Calculation of return on equity requires some additional calculations and assumptions:

- terms of foreign capital
- checking that the financing plan is accurate.

The calculation is shown in Table 5 and the original cash flow converted into return on equity in Table 6.

Note the curious calculations in the first year. This is because the company is still financing the operations by raising fresh loans.

Table 5

TENTATIVE FINANCING PLAN

	Construction period			Operating period						
	-3	-2	-1	1	2	3	4	5	6	7
Sources of funds										
- operating margin	-	-	-	800	2 840	4 100	4 100	4 100	4 100	4 100
- equity capital	2 000	2 000	1 000	-	-	-	-	-	-	-
- foreign debt	1 500	2 310	4 473	1 707	-	-	-	-	-	-
TOTAL SOURCES	3 500	4 310	5 473	2 507	2 840	4 100	4 100	4 100	4 100	4 100
Application of funds										
Investment										
- fixed investment	3 500	4 100	4 000	500	-	-	-	-	-	-
- replacements	-	-	-	-	100	400	400	400	400	400
- working capital	-	-	1 000	1 000	500	-	-	-	-	-
Taxes	-	-	-	-	-	150	150	150	150	150
Interest on debt	-	150	381	828	999	909	729	549	369	189
Amortizations of debt	-	-	-	-	900	1 800	1 800	1 800	1 800	1 890
Fees on debt	-	60	92	179	68	-	-	-	-	-
Dividends (not incl.)	-	-	-	-	-	-	-	-	-	-
TOTAL APPLICATIONS	3 500	4 310	5 473	2 507	2 567	3 259	3 079	2 899	2 719	2 629
Financing balance of the period	0	0	0	0	273	841	1 021	1 201	1 381	1 471
Cumulative financing balance	0	0	0	0	273	1 114	2 135	3 336	4 717	6 188
Cumulative debts	1 500	3 810	8 283	9 990	7 290	9 090	5 490	3 690	1 890	-
Debt service coverage	-	-	-	-	1.5	1.5	1.6	1.7	1.8	1.9
Operating										

Table 6

CONVERSION OF CASH FLOW STATEMENT FOR CALCULATION OF RETURN ON EQUITY

	Construction period			Operating period								
	-3	-2	-1	1	2	3	4	5	6	7	8-14	15	Salvage
Operating margin	-	-	-	0	2 840	4 100	4 100	4 100	4 100	4 100	4 100	3 900	-
Taxes paid	-	-	-	-	-	150	150	150	150	150	150	500	-
Equity injection	2 000	2 000	1 000	-	-	-	-	-	-	-	-	-	-
Replacement	-	-	-	-	100	400	400	400	400	400	400	-	-
Non financed portion of working capital	-	-	-	-	500	-	-	-	-	-	-	-	-2 500
Loan service and fees	-	-	-	-	1 967	2 709	2 529	2 349	2 169	2 079	-	-	-
Salvage value	-	-	-	-	-	-	-	-	-	-	-	-	1 000
CASH FLOW	-2 000	-2 000	-1 000	0	237	841	1 021	1 201	1 381	1 471	3 550	3 400	3 500

IRR on equity = 20%
IRR on total capital = 17%
Loan interest rate = 10%

Comparison of Profitability Analysing Methods for New Projects

	Advantages	Disadvantages
Simple rate of return Engineer's ROI	- Simple and easy to use	- Disregards the time-value of money - The many different calculation possibilities may lead to misunderstandings
Pay-back period	- Simple and fast method	
Net present value	- Takes account of time-value of money - Accounts for the whole project lifetime - Projects with different time schedule are comparable	- Somewhat complicated to calculate - The choice of interest rate is subjective - Gives unclear picture of the profitability
Internal rate of return	- Takes account of time-value of money - Accounts for the whole project lifetime - Projects with different time schedules comparable - Gives clear picture of the profitability - Only one value	- The most complicated of all the methods - Many distortions possible in refining the results
Benefit/cost ratio	- Takes account of time-value of money - Accounts for the whole project lifetime - Projects with different time schedules are comparable	- Complicated to calculate - Has no advantages over the NPV or IRR method - Not widely used - Gives unclear picture of profitability

6. FINANCIAL RATIOS OF OPERATING COMPANIES

6.1 General

In each country there are different practices in use for producing income statements, balance sheets and other legally required financial calculations. Fortunately, these calculations have much in common. The difficulty in their analysis lies in the valuation items, reservations, funds and shares. A specialist in the country's systems is required to get a clear picture of an operating company.

Typical calculations for operating companies are presented below in the form of an income statement, a balance sheet and a financing plan.

Income statements and balance sheets are usually obligatory by law, but a detailed financing plan is usually a company's own affair. Therefore the financial ratios are usually based on figures obtainable from the first two tables mentioned above.

In the financing plan some typical financial ratios are collected with reference to their target values. In countries like Finland, the forest industry runs close to the bottom line indicators. The whole economic environment should in such countries be adapted to this fact. In countries where strict rules of sound economy are followed, constant bottom line indicators are not allowed. What is common in all countries is the year by year development of the ratios, which is far more important than the actual level.

INCOME STATEMENT

Period (year)	19..	19..	19..	19..
Sales				
- Correction of sales				
= Turnover (mill net basis)				
- Variable cost (corresponding to turnover)				
= Contribution margin				
- Fixed cost				
- Overheads				
= Operating margin				
- Interests paid				
+ Interests earned				
- Taxes				
= Financing results				
- Depreciations				
= Profit from operation				
+ Other incomes				
- Other cost				
+/- Other adjustments on the result				
PROFIT/LOSS FOR THE PERIOD				

BALANCE SHEET (ONE PERIOD)

ASSETS		LIABILITIES
Current assets		Current liabilities
Cash		Payables
Receivables		Accruals
Inventories		Short-term debts
		Next year amortizations of long-term debts
Fixed assets		Long-term liabilities
Land		Foreign debts
Buildings		
Equipment		Valuation and reserves
Vehicles		
Shares and rights		Equity capital
Capitalized interests		
		Share capital, common stock
Other items		Retained earnings or cumulative loss
Long-term investments		
Valuation items		
TOTAL ASSETS	=	TOTAL LIABILITIES

FINANCING STATEMENT

Period (year)	19..	19..	19..	19..
Sources of funds				
Operating income				
Other income/cost				
Increase of share capital				
Debts increase				
TOTAL SOURCE				
Application of funds				
Investment and other similar items				
Change of working capital				
Amortization of debts				
Interests				
Taxes				
Dividends				
TOTAL APPLICATIONS				
Financing balance of the period				
Cumulative financing balance				

EXAMPLES OF FINANCIAL RATIOS FOR OPERATING COMPANIES

		Poor	Satisfactory
1	Operation indicators		
1.1	Operating margin of turnover (percentage)	< 20 %	20...29 %
2	Profitability		
2.1	Return on total assets (ROI)		
	$i = \frac{\text{Profit + Investments}}{\text{Total assets}}$ *)	< 10%	> 10%
	*) before valuation items		
2.2	Return on net worth		
	$i = \frac{\text{Profit}}{\text{Total equity capital}}$	< 15%	> 15%
3	Debt service coverage		
	$DSC = \frac{\text{operating margin + other income - cost}}{\text{interests + amortizations}}$	< 1.3	> 1.5
4	Liquidity		
	$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$	< 1.5	> 2.0
5	Leverage, solidity		
	Debt to total assets (degree of debts) $= \frac{\text{Total debts}}{\text{Equity capital}}$	> 60%	< 50%

7. ANALYSIS OF ECONOMIC PROFITABILITY

7.1 General

This analysis uses the same measures of profitability as the commercial one. The difference is the extent and price setting of input and output variables.

Costs are defined in terms of value of opportunities lost by society because optimum use is not made of project resources.

The benefits of the projects are those of increased goods or service availability for society, from the project.

The prices and costs used here are accounting prices (AP) or shadow prices which reflect the value of resources gained or lost by the national economy as a whole.

The main elements which should first be excluded from the economic profitability calculations are the following:

- duties and taxes
- incentives and subsidies
- the effect of monopóly (one or few sellers setting minimim prices) and monopsony (one or few buyers).

In theory there is no final, absolute limit of details which can be involved and analysed when calculating economic profitability; but in practice one should use one's own judgement to decide which parameters are important and leave out those which can be discarded. Otherwise, the calculation will take unnecessary effort and time without major or significant improvement in the results. In that sense, the results of economic profitability analyses are never perfectly accurate; they give only a good estimate of the reality.

The main items which should be analysed and converted may be as follows:

7.2 Project outputs

AP (accounting price) for products:

- for export	= FOB export price	-	transport and handling costs from mill to ship
- import substitute	= CIF import price	+	transport and handling cost of import from port to consumer
		-	transport and handling costs from mill to consumer

Here the transport and handling costs are measured as AP.

7.3 Project inputs

Traded items

When the domestic price is higher than the FOB export price but below the CIF import price, or there are effective quotas or prohibitive duty tariffs;

- of imports = CIF import price + transport and handling costs from port to mill

- of diverted exports = FOB export price - transport and handling costs from source to port

+ transport and handling costs from source to mill

Non-traded items

The domestic market prices are first converted into their economic worths if the market prices do not adequately reflect them. This economic worth is then converted into APs. The distortions in the prices of non-traded goods relative to the prices of traded goods are corrected. Such distortions exist because of import and export taxes, subsidies, quantitative restrictions of trade and sales taxes. For all non-traded items, an economy-wide standard conversion factor can be used.

The simplified equation is as follows:

$$SCF = \frac{VI + VE}{(VI + VIT) + (VE + VET)}$$

where:

SCF = standard conversion factor
VI = value of imports
VE = value of exports
VIT = value of import tax
VET = value of export tax (negative if subsidized)

This equation can be further simplified as follows:

$$SCF = \frac{VI}{VI + VIT}$$

More specific conversion coefficients can be determined for some important non-traded items like labour and (tree-)stumpage.

Labour can be further divided into unskilled, semi-skilled and skilled labour categories. First determine the opportunity costs at domestic prices and then convert to APs using the SCF.

The opportunity cost of labour is understood to mean what is given up by the economy when a worker takes a new job, plus the effort involved in changing a job. The actual wages often tend to be above the minimum that workers would be willing to accept for employment, should they be unemployed because of government or labour union action. Sometimes the new industry must pay higher wages to persuade workers to change their jobs. This type of distortion should also be eliminated in the economic profitability analysis.

The land or forest often does not have any benefit - or has a very limited one - to society without the project, and therefore there could be little or no cost.

Transport and power prices should be examined whether they are subsidized or not (for example in the form of low national oil prices). Sometimes it may be desirable to break down these costs into further detail (water, rail or road transport, peak or normal consumption).

The investment should also be transferred to AP. Making a detailed breakdown and transferring it is usually the most convenient way to do

this. Investments in infrastructure, although necessary for the project, lead to improvements in society (for example, housing) or better utilization of national resources (for example, transport and land use). For this reason, they should be excluded when calculating the economic rate of return (ERR).

7.4 Calculation of ERR

The calculation of ERR is similar to the calculation of IRR. The problem is in determining the accounting prices.

To summarize:

- leave out all taxes and duties, incentives and subsidies from the calculations;
- reckon current labour cost according to local conditions;
- correct domestic raw material prices to the situation where increasing demand is correctly interpreted;
- correct all local cost inputs by standard economy-wide conversion factor for the society in question (measures present degree of economic strength);
- calculate IRR normally;
- target value of ERR is 12% or more.

8. REMARKS

8.1 Inflation

Some people try to get the profitability indicators to look better by including a positive inflation effect on all earnings and then paying off non-inflated investments in the beginning.

Without any further comments: do not be tempted to do this. An investment decision based on such material is unsound.

If the profitability indicators are not satisfactory, pay greater attention to the competition, marketability and strategic questions before making a positive decision.

8.2 Project risks and sensitivity analyses

Business is an activity in which not only skill but also chance plays a part. Thus probability comes into the picture.

There are two ways to take risks into account:

1. Without numerical methods, using intuition or "guesstimating", and believing afterwards that one is on the safe side, without knowing by how much;
2. The quantitative way, using numerical methods and calculating that "how much".

Some methods in practice:

- revenues conservatively estimated
- risk reservations added to costs

- required shorter pay-back period ·

- calculating three alternatives:
  1. pessimistic expectations
  2. optimistic expectations
  3. most likely, or most probable expectations

- using sensitivity analyses

- statistical methods
  . measured survival function (MSF) and its probability distribution
  . "Monte Carlo" method

- adopting business cycles in the calculations.

With the growing use of computers, numerical methods are increasingly preferred.

In practice, the methods using probability techniques are the most complicated ones, and there is always the question of who should quantify the risk factors involved (the analyst or the decision maker), and which are the components open to risk.

Without getting deeper into describing risk measuring methods, here is a short list of the main factors which should be studied to find the project risk:

Output

Marketability factors
- market place
- volume
- price
- product quality
- competition
- price leaders

Natural factors
- climate
- earthquake
- fire
- insects
- diseases
- local weather
- water level changes

Technology and productivity

Supply/availability and cost of:
- raw materials
- chemicals
- energy
- water, etc.
- pricing mechanism

Capacity utilization
- technology
- bottlenecks
- organization

Financial and economic factors
- availability and cost of capital
- financing possibility of cost overruns

Human factors
- labour availability and cost
- organization
- productivity
- training

Infrastructure and connections factors
- availability and cost
- cost share of the mill

Special factors
- political stability
- laws and regulations

General time schedule for all factors.

Agricultural tractor with winch attachment winching a log (Photo: H. Seppanen)